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GREAT LAKES WATER QUALITY

INTERNATIONAL JOINT COMMISSION-UNITED STATES AND CANADA

APRIL 1974

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The report provides an assessment of the present water quality of the Great Lakes and their connecting channels and critically examines the data collection and analysis programs available for this evaluation.

The status of remedial programs being implemented to achieve the objectives for water quality in the lakes as agreed to under the 1972 Canada-U. S. Agreement is reviewed. The report highlights progress in reducing pollution from municipal waste discharges and notes that while significant progress is being made, particularly with regard to reducing phosphorus inputs to control eutrophication, several major sewage treatment facilities will not be completed by 1975.

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INTERNATIONAL JOINT COMMISSION
GREAT LAKES WATER QUALITY BOARD

April 1974

International Joint Commission

Canada and United States

Gentlemen:

The International Great Lakes Water Quality Board, as a requirement of the Water Quality Agreement of 1972, is submitting the following Annual Report on Great Lakes Water Quality prepared by the Board.

Respectfully submitted,

A. T. Prince
Chairman
Canadian Section

F. T. Mayo
Chairman
United States Section

GREAT LAKES WATER QUALITY

SECOND ANNUAL REPORT

TO THE

INTERNATIONAL JOINT COMMISSION

GREAT LAKES WATER QUALITY BOARD

APRIL 1974

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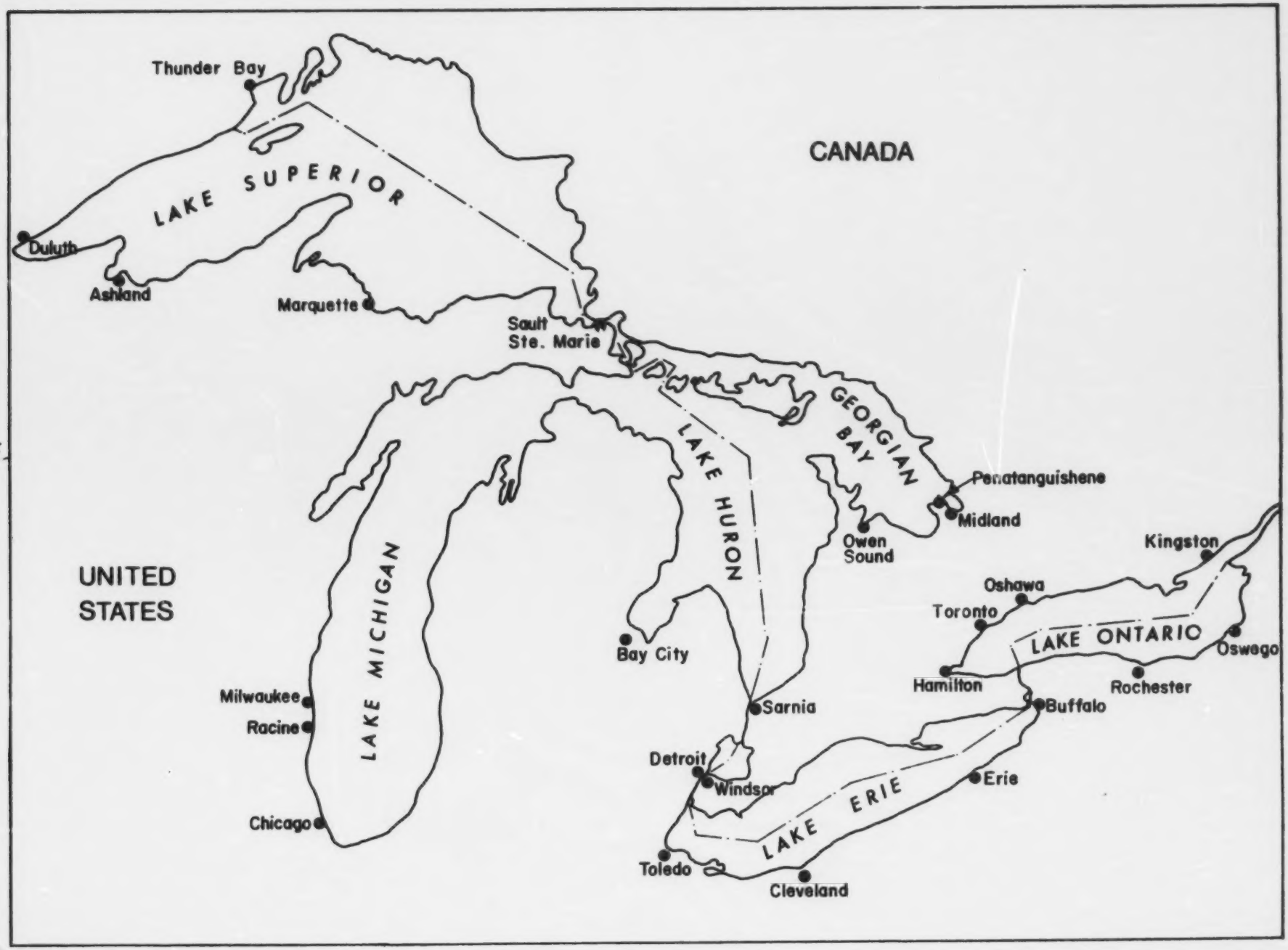
Thunder Bay
CANADA
LAKE SUPERIOR
Duluth
Ashland
Marquette
Sault
Ste. Marie
GEORGIAN
BAY
LAKE HURON
Penatanguishene
Midland
Owen
Sound
Kingston
UNITED
STATES
LAKE MICHIGAN
Oshawa
Toronto
LAKE ONTARIO
Oswego
Bay City
Hamilton
Rochester
Milwaukee
Racine
Sarnia
Buffalo
Detroit
Windsor
Erie
Chicago
LAKE ERIE
Toledo
Cleveland

SUMMARY

Baseline water quality investigations of lakes Superior, Huron, and upper Michigan are in progress as a part of the Upper Lakes Reference. Locally, data from connecting channels have been taken to suggest improvements due to phosphorus controls and other remedial measures. However, the information and statistical analyses provided by the various agencies do not support these suggestions with any high degree of confidence. Available information indicates that during 1973, overall water quality measured in Lake Erie was essentially unchanged from conditions found in 1970.

In general the assessment of water quality data trends has greatly lagged the data collection programs. If federal, state and provincial agencies wish to provide satisfactory assessment of the waste loadings from municipal and industrial sources and evidence of changes in Great Lakes water quality resulting from remedial programs now under way throughout the basin, they will need to assign greater resources to data storage, retrieval, analysis, interpretation and quality control.

The original fishery resources of the Great Lakes has been directly and seriously affected by man's activities in the basin. While the average total annual commercial catch in the five Great Lakes has not changed substantially

since 1900, the species composition of the catch has changed dramatically, and stocks of formerly abundant high valued species are low or absent. The demand for recreational fishing has risen sharply in recent years, enough so that it has contributed to a deficit in supply and to excessive pressures on smaller inland waters. Rehabilitation of fish populations is presently underway in portions of each of the lakes where the Great Lakes Fishery Commission's sea lamprey control program has been successful. Fish population targets are not likely to be met either locally in the upper Great Lakes or more generally in the lower lakes until water quality is improved.

It is reported that both the U.S. and Canadian programs for the abatement and control of municipal discharges to the Great Lakes Basin are adequate to achieve the water quality objectives as outlined by the Agreement. However, because of many unforseen delays, particularly in the United States, it is extremely unlikely that these programs will be completed by 1975.

State agencies are concerned about the complexity of regulations and legal requirements of the federal law 92-500. The following statement by New York expresses the general attitude of all states:

> *"In the years prior to the passage by the United States Congress of the Federal Water Pollution Control Act Amendments of 1972, Public Law 92-500, the individual States had full control over the selection of wastewater treatment facilities projects on which to proceed to construction. This option was possible due to the provisions of the prior Act, Public Law 84-660 as amended, whereby the States had authority to prefinance the inadequate federal funding available for the program.*

This authority ended on June 30, 1971, and the temporary continuing legislation deleted the previous reimbursement clauses.

With the passage of Public Law 92-500 on October 18, 1972, full federal funding was required for only those projects eligible under a rigid priority system in accordance with federal guidelines. Other requirements added by the Act or U.S. Environmental Protection Agency regulations, such as complete plans and specifications, infiltration/ flow surveys and analysis, environmental assessment statements and public hearings, cost-effectiveness criteria requiring comparative alternative design; all subject to... federal scrutiny, effectively retarded the progress of the program."

One of the major programs for meeting the water quality objectives under the Agreement is the construction (and operation) of facilities to provide "adequate treatment" of municipal sewage. Adequate treatment has been defined by Canada and the U.S. on a slightly different basis. In the United States secondary treatment with phosphorus removal is considered the minimum acceptable level. The Canadian approach is more flexible, allowing less than secondary treatment, with or without phosphorus removal, depending on receiving water conditions. Recognizing these differences the following discussion provides a measure of progress.

A total population of 20,156,000 are served by sewers in the Great Lakes System. Adequate treatment was provided for 23 per cent of these people in 1971, 47 per cent in 1973, and it is expected that it will be provided for 68 per cent in 1975.

In Canada, 349 municipal systems serving a population

of 4,836,000 provided adequate treatment for 80 per cent of the population in 1971, 84 per cent in 1973, and will serve 98 per cent in 1975.

In the United States the 946 municipal systems serving a population of 15,320,000 provided adequate treatment for 5 per cent of the population in 1971, 35 per cent in 1973 and will serve 58 per cent by 1975.

The reduction of phosphorus in detergents and implementation of phosphorus removal at municipal waste treatment plants is reported to have further reduced phosphorus loadings to all the Great Lakes except Lake Erie. The Lake Erie loading has increased because the reported phosphorus load from the City of Detroit increased. However, as in the other lakes, residual loads still do not exceed Agreement projections.

Industrial programs required by federal regulations in the United States cannot presently be assessed. The National Pollutant Discharge Elimination System (NPDES) Permit Program, after a slow start in terms of permits issued, could provide the basis for an effective method of controlling pollution from industrial point source discharges by early 1975 or no later than 1977.

Under the Fisheries Act the Canadian Federal government is developing a program to control industrial waste discharges. The program is based on the concept of Best Practicable Technology for treatment combined with a minimization of water use. The development of regulations is a co-operative exercise between Federal and Provincial

governments as well as industrial interests. To date, three sets of regulations have been promulgated.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Water Quality Of The Great Lakes

The Board concludes that, based on available information, the water quality of Lake Erie and Lake Ontario generally has not changed significantly from 1970 to 1973. There are, however, some definite signs of improvements in certain previously defined problem areas. Baseline water quality investigations of lakes Superior, Huron and upper Michigan are in progress as a part of the Upper Lakes Reference Study.

The Board further concludes that the assessment of water quality data has seriously lagged the collection of the basic data and that this is due to the lack of coordinated effort in surveillance and monitoring programs. As a result, trends in water quality, except for a few specific areas, cannot be established with any degree of statistical certainty.

Municipal and Industrial Programs and Legislative Measures Affecting Them

The Board concludes that substantial progress has been achieved towards the attainment of objectives outlined in the Agreement.

Accomplishments have been measured both in terms of an increase in the percentage of the total sewered population

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being served by adequate sewage treatment (23 percent in 1971 to 47 percent in 1973), and in terms of funds expended ($1.168 billion since 1971). Projections to December of 1975 indicate that 68 percent of the total sewered population within the Great Lakes System will be served by adequate sewage treatment.

The Board also concludes that many delays are being encountered, some involving large projects. Delays in Ontario seem to be primarily due to lagging engineering studies. Within the U.S., current delays in obtaining federal funding for construction of municipal treatment facilities are due to more complex regulatory requirements imposed by EPA in implementing PL 92-500. However, it is expected that programs established under PL 92-500 will result in a much higher degree of pollution control than was required at the time of the Agreement. Future delays in construction are also expected as a result of the continuing impoundment of appropriated funds by the Executive Branch of the Federal government.

Major municipal sewage treatment projects that will not be completed by December 31,of 1975 include:

Detroit-Metro, Michigan (1976)
Cleveland Regional Sewer District, Ohio (1978)
Buffalo, New York (1979)
Niagara Falls, New York (1976)
Duluth Western Lake Superior Sanitary District, Minnesota (1976)

The Board concludes that specific industrial programs in Ontario show a moderate degree of progress in that major industries have completed required treatment facilities. Most industries are currently committed to abatement programs and are expected to complete construction of necessary treatment facilities by the end of 1975. Industrial effluent guidelines for three classes of industry are in effect.

Progress in the U.S. towards abatement and control of industrial pollution can only be measured in general terms at this time. The National Pollutant Discharge Elimination System (NPDES) Permit Program (which encompasses all point source discharges) is well underway. Although this program promises substantial reduction of industrial waste loads to the Great Lakes system, the realization of such achievements is not expected until 1977. Proposed effluent guidelines for twenty-three industrial classifications have been published by the U.S. EPA in 1973.

Eutrophication

The Board concludes that a major effort is being made in the U.S. and Canada to reduce the discharge of phosphorus to the Great Lakes. The reduction of the phosphorus content of detergents in Canada, Indiana, Michigan and New York, and the implementation of phosphorus reduction at municipal sewage treatment plants has resulted in phosphorus loadings which are lower than projected targets under the Agreement, Annex 2, for the Lower Lakes, and Appendix I for the Upper Lakes.

In the Lake Erie Basin, a total of 116 of the 198 municipal treatment plants requiring phosphorus removal were operational by December 31, 1973. This provides phosphorus reduction for more than 80 percent of the sewered population in the basin.

Vessel Wastes

The Board notes with concern that compatible regulations for the control of vessel wastes have not yet been adopted.

Waste Loading

The development of a sound basis for evaluating changes in waste loadings to the Great Lakes has been hindered by the incompleteness and variability of the data.

RECOMMENDATIONS

The Great Lakes Water Quality Board recommends:

(1) that, as recommended in the 1973 Annual Report, the Commission, in written communication, urge the Federal, State and Provincial governments to assign greater resources to data analysis, interpretation and quality control in order to provide a satisfactory assessment of water quality and evidence of changes resulting from remedial programs now underway in the basin.

(2)(a) that the U.S. Federal government provide full utilization of appropriated funds for construction of treatment plants in the Great Lakes System.

(b) that funds currently available at all levels of government be obligated to Great Lakes projects as soon as possible.

(c) that States and Provinces be requested to complete major construction projects on a priority basis in the Great Lakes Basin.

(3) that the U.S. Government be requested to utilize all reasonable means at its disposal to assure expeditious completion of the following major municipal projects:

Detroit-Metro, Michigan
Cleveland Regional Sewer District, Ohio
Buffalo, New York
Niagara Falls, New York
Duluth, Western Lake Superior Sanitary District, Minnesota

(4) that special efforts be made to complete the construction of phosphorus removal facilities on schedule. Interim measures should be undertaken where construction delays are unavoidable.

(5) that in keeping with the Commission's earlier recommendations, the Governments adopt compatible regulations for disposal of vessel wastes requiring complete prohibition of discharge of sewage. (A minority recommendation by two Canadian Board members is that in addition to total confinement, options be provided for flow through devices which meet strict effluent quality criteria.)

(6) that the Commission urge U.S. and Canadian, Federal, State and Provincial Governments to develop compatible data collection, storage and retrieval systems which permit interfacing and data exchange.

INTRODUCTION

In its 1970 report to the Governments of Canada and the United States on pollution of Lake Erie, Lake Ontario and the International Section of the St. Lawrence River, the International Joint Commission (IJC) recommended that the Governments agree to develop compatible programs for the control of pollution of the Great Lakes System.

The two Governments met in June, 1970, to consider appropriate methods for implementing the IJC recommendations. They appointed a Joint Working Group to develop agreed-upon water quality objectives, programs and other measures for preventing and controlling pollution of the Great Lakes.

The Governments met again in June of 1971 to negotiate an executive agreement between the two countries. The Great Lakes Water Quality Agreement was finally concluded in Ottawa April 15, 1972, when it was signed by Prime Minister Trudeau and President Nixon.

The IJC was directed in the Agreement itself to assist the Governments to implement it, and to make an annual report on progress in achieving its objectives. To assist in carrying out the powers and responsibilities assigned by the Agreement, the IJC was further directed to establish a Great Lakes Water Quality Board. The Board appointed committees to develop the first annual report to the IJC

containing information required for annual reports to the Governments. This second annual report was prepared by these committees working closely with the IJC Great Lakes Regional Office, which was established in 1973 at Windsor, Ontario.

This report presents a current assessment of water quality in the boundary waters and of control programs and other measures set forth in the Agreement. The progress achieved in construction of facilities to reduce waste discharges to the Great Lakes System is presented in summary form. Detailed information on programs and water quality is available in the files of the IJC Regional Office at Windsor.

WATER QUALITY OBJECTIVES

The Board has established a Water Quality Objectives Subcommittee to advise the IJC in its responsibilities relative to refinement and amendment of general and specific water quality objectives and the Subcommittee has not as yet recommended changes.

The Subcommittee does, however, plan to review and make recommendations as follows:

Proposed Target Dates for Evaluating Water Quality Objectives

1974	1975
Persistent organic contaminants	General water quality
Arsenic	Taste and odor
Barium	Iron
Cadmium	Settleable and suspended solids
Chloride	Petrochemicals and immiscible substances
Chromium	Phenols
Copper	Phthalates
Cyanide	Other pesticides
Fluoride	Hydrogen sulphide
Lead	General toxicity objective
Mercury	Total dissolved solids
Nickel	

1974	1975
Organic chemicals	Microbiology
Oil	Linear-Alkyl-Sulfonate
Selenium	Chlorine
Zinc	Temperature
Dissolved oxygen	Radioactivity

In early 1974 a conceptual framework into which water quality objectives can be placed will be submitted to the Board.

The Subcommittee reports that no action is possible at this time on establishment of a qualitative or quantitative objective for asbestos in water. Current litigation between the U.S. Government and Reserve Mining Company may have a significant bearing on the establishment of an objective. Requests have been made for further study by various other committees regarding total dissolved solids, phosphorus, sulphate and other nutrients prior to the Subcommittee's recommendations.

The specific objective for radioactivity is currently being considered by a joint Canada/U.S. Technical Group. The Radioactivity Work Group of the Water Quality Objectives Subcommittee has met to consider its relationship to the Technical Group and to establish a course of action.

WATER QUALITY

SUMMARY

The International Joint Commission, relying on the Water Quality Board's April 1973 report, stated in its report to the Governments that "there was not yet available a scientific basis to indicate in precise terms the extent of improvement" or degrees of change in the water quality of the Great Lakes. Long-term variations are due to variations in weather, runoff and water levels.

Since the definition of an IJC Surveillance Program has recently been assigned to the new Surveillance Sub-Committee, the information in this report is based on a variety of agency programs, (enforcement, monitoring, and special studies) with no detailed pre-submission prescription of how they might be integrated. The preparation of this report has highlighted the lack of a prescription and the need for better coordinated analytical quality control. Unfortunately the assessment of trends at this time is hampered by these difficulties. As the program is developed in the coming year, existing data collection programs and past data can be examined with this perspective.

Improvements are being made in many of these areas, particularly with the addition of staff and responsibilities to the Regional Office. Meanwhile, available information

indicates that during 1973, water quality measured in Lake Erie was essentially unchanged from conditions found in 1970. Baseline water quality investigations of lakes Superior, Huron, and upper Michigan are in progress as a part of the Upper Lakes Reference. Locally, data from connecting channels have been taken to suggest improvements due to phosphorus controls and other remedial measures. However, the information and statistical analyses provided by the various agencies do not support these suggestions with any high degree of confidence.

In general the assessment of water quality data trends has greatly lagged the data collection programs. Federal, state, and provincial agencies will need to place great emphasis on data storage, retrieval, analysis, interpretation and quality control if they are to provide satisfactory assessment and evidence of changes in Great Lakes water quality resulting from remedial programs now under way throughout the basin.

The original fishery resource of the Great Lakes has been directly and seriously affected by man's activities in the basin. Selective and intensive commercial fishing has contributed to the serious reduction of several valuable species. Changes in the watershed and water quality degradation have eliminated some essential reproduction areas and have contributed to a serious stress load in the general fish communities. The introduction or invasion of new species such as the sea lamprey, smelt, and alewife, has placed intensive stress on native populations, altered the mechanisms of competition and predation, and has contributed directly to the virtual elimination of some species from the commercial catch. While the average total annual

commercial catch in the five Great Lakes has not changed substantially since 1900, the species composition of the catch has changed dramatically. The early Great Lakes Fisheries (circa 1900) consisted of lake trout, white fish, lake herring, chubs, walleye and sturgeon. These species are today of minor significance in the Great Lakes fishery. The present major commercial species (in terms of total annual landings) are carp, smelt, alewife and perch.

The response, by recreational fishermen, to the creation of fishing opportunities by the introduction of salmon has been a clear demonstration of the sharply increasing demand for recreational fishing. The successful sea lamprey control program of the Great Lakes Fishery Commission has apparently removed one major constraint on the capacity of the lakes to support natural fish communities and to provide opportunities for the needed recreational fishing. Rehabilitation programs are moving forward. Management agencies, having recognized the impact of exploitation on fish stocks, are actively moving towards better mechanisms to achieve control of that stress. The last remaining constraint to natural fish production in the Great Lakes, locally in the upper lakes, and generally in the lower lakes, is degraded water quality. Rehabilitation of native fish stocks is not likely to be successful until there is a substantial improvement in water quality. Although some fishing opportunities can be provided on a short term basis by the introduction of desirable species like the salmon, such fisheries are expensive and difficult to maintain. They are in essence a costly and uncertain substitute for fishing based upon natural reproduction by native stocks.

WATER QUALITY ASSESSMENT PROGRAMS

A summary of the sampling programs carried out by the various agencies in each lake in 1973 is given in Table 1. Analyses of samples collected include a wide range of parameters from frequent analyses for standard physical, chemical, bacteriological and nutrient parameters, to infrequent analyses for such items as trace metals, pesticides, PCB's and radiological parameters.

The objectives of the agencies vary in these programs as reflected in differing emphasis on onshore or midlake conditions, different assessment of the needs for number of sampling locations and frequency of sampling, and the degree to which past records have been examined for assessment of trends. For example, sampling designed for enforcement is directed to specific sources and the data might simply be examined for exceedence of specific water quality objectives. On the other hand, programs designed to assess trends present information for a series of years.

Both types of reports have been submitted for 1973; consequently, degrees of compatibility vary. These reports form the basis of the following discussions of water quality conditions. In general terms, emphasis has been placed on Lake Erie and the Detroit River areas for which the most trend information is currently available. Lakes Superior and Huron are the subject of an extensive baseline study as a part of the Upper Lakes Reference. Some material from these studies has been made available, but a more definitive assessment is expected in late 1975. Lake Ontario was the subject of intensive study in 1972-73 in

TABLE 1

GREAT LAKES WATER QUALITY ASSESSMENT PROGRAMS

AGENCY	SAMPLING PROGRAM		SAMPLING LOCATION		NO. OF STATIONS		
	No. of Surveys per year or frequency	Duration or period (months)	Shoreline	Mid-Lake	Tributaries	Lakes	Connecting Channels
LAKE SUPERIOR							
U.S. EPA Region V	Monthly	I - XII	X		30		
Canada DOE CCIW	6	V - XI				144-200	
Ontario	4	VII - XI	X		60	67	
Minnesota	Monthly Yearly	I - XII --	X	 X		3 6	
Michigan	12 Every 5 years	I - XII	 X		5	 90	
ST. MARYS RIVER							
U.S. EPA REGION V	6	VII, VIII, IX					26
Canada DOE CCIW	2	VIII, XI					34
Ontario	3	V, VI, VIII			17		55

NS - Data not specifically supplied but are included in statewide reports which do not permit ready separation and identification of activities within Lake Basins.

X - Sampling being carried out.

TABLE 1

GREAT LAKES WATER QUALITY ASSESSMENT PROGRAMS

AGENCY	SAMPLING PROGRAM		SAMPLING LOCATION		NO. OF STATIONS		
	No. of Surveys per year or frequency	Duration or period (months)	Shoreline	Mid-Lake	Tributaries	Lakes	Connecting Channels
LAKE HURON							
U.S. EPA Region V	2	XI, XII		X		12	
Canada DOE CCIW	2	V, IX		X		10-13	
Michigan	Every 5 years	V - IX	23	25		50	
	12	I - XII			17		
Ontario	3	VII, VIII XII	X		235	9	
LAKE MICHIGAN							
Wisconsin			X		NS	14	
Michigan	Every 5 years	V, IX	25	25		50	
	12	I - XII			22		
Illinois	1	V, IX	43	8		51	
Indiana	25	I - XII			22	5	

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X - Sampling being carried out.

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GREAT LAKES WATER QUALITY ASSESSMENT PROGRAMS

AGENCY	SAMPLING PROGRAM		SAMPLING LOCATION		NO. OF STATIONS		
	No. of Surveys per year or frequency	Duration or period (months)	Shoreline	Mid-Lake	Tributaries	Lakes	Connecting Channels
ST. CLAIR RIVER							
U.S. EPA Region V	6	II, V, VI - VII					47
Ontario	4	V, VI, VIII, X			3		42
Michigan	12	I - XII			3		
LAKE ST. CLAIR							
U.S. EPA Region V	2	V, VIII		X		13	
Ontario	3	V, VI, VIII		X	25	12	
DETROIT RIVER							
Michigan	5	V, IX					60
	12	I - XII			2		
Ontario	3	V, VI, VII			2		60

NS - Data not specifically supplied but are included in statewide reports which do not permit ready separation and identification of activities within Lake Basins.

X - Sampling being carried out.

TABLE 1

GREAT LAKES WATER QUALITY ASSESSMENT PROGRAMS

AGENCY	SAMPLING PROGRAM		SAMPLING LOCATION		NO. OF STATIONS		
	No. of Surveys per year or frequency	Duration or period (months)	Shoreline	Mid-Lake	Tributaries	Lakes	Connecting Channels
LAKE ERIE							
U.S. EPA Region II	8	II - X	X			3	
U.S. EPA Region V	18	II - XI	X			18	
U.S. EPA Research	5	VII-XII	X			77	
Canada DOE CCIW	4	IV - XI		X		84-121	
Michigan	1 in 5 years	V - VIII	25	25		50	
	12	I - XII			2		
Ohio	-	Manual	X		8	15	
	-	V - VIII				6	
Pennsylvania	Monthly	V - VII	X		3	9	
New York	Monthly				3		
Ontario	3	VI,VII, VIII	X		69	108	

NS - Data not specifically supplied but are included in statewide reports which do not permit ready separation and identification of activities within Lake Basins.

X - Sampling being carried out.

TABLE 1

GREAT LAKES WATER QUALITY ASSESSMENT PROGRAMS

AGENCY	SAMPLING PROGRAM		SAMPLING LOCATION		NO. OF STATIONS		
	No. of Surveys per year or frequency	Duration or period (months)	Shoreline	Mid-Lake	Tributaries	Lakes	Connecting Channels
NIAGARA RIVER							
U.S. EPA Region II	26	I - XII					1
Ontario	3	VI,VII,IX			6		37
New York	6	I - XII			3		6
LAKE ONTARIO							
U.S. EPA Region II	26	I - XII			2		
U.S. EPA Research	4	II,III,IV VI	105	300		405	
Canada DOE CCIW	4	III - XII		X		32-96	
New York	6	I - XII			3	2	
Ontario	3	VI,VII,IX	X		184	85	
U.S. G.S.	8	I - XII				8	

NS - Data not specifically supplied but are included in statewide reports which do not permit ready separation and identification of activities within Lake Basins.

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TABLE 1

GREAT LAKES WATER QUALITY ASSESSMENT PROGRAMS

AGENCY	SAMPLING PROGRAM		SAMPLING LOCATION		NO. OF STATIONS		
	No. of Surveys per year or frequency	Duration or period (months)	Shoreline	Mid-Lake	Tributaries	Lakes	Connecting Channels
ST. LAWRENCE RIVER							
U.S. EPA Region II	4	I, IV, VII X					3
Canada DOE CCIW	3	V, VI, IX					69
New York	6	I - XII			3		1

NS - Data not specifically supplied but are included in statewide reports which do not permit ready separation and identification of activities within Lake Basins.
X - Sampling being carried out.

the International Field Year for the Great Lakes and a preliminary analysis of these data should be available by late 1974 or early 1975.

WATER QUALITY CONDITIONS

In reviewing water quality conditions, it was deemed necessary to concentrate discussion on two units of the Great Lakes System this year. However, very brief summaries concerning the other bodies of water are included.

For connecting channels, as has been the case in earlier reports, some specific sources of pollutants have been identified. This has not been done for the lakes sections because of the size of the inventory that would have to be assembled. This last aspect is covered more thoroughly in the Lower Lakes and Upper Lakes Reference Studies.

Lake Superior

During 1973, mid-lake samples indicated excellent quality with low concentrations of dissolved and suspended solids, nutrients, and major ions. Samples from populated areas showed moderate increases in nearshore nitrogen and phosphorus. There was no conclusive evidence of trends in water quality.

St. Marys River

Water quality in 1973 was little changed from that reported in 1971. Locally, the discharge from Algoma Steel Corporation in Sault Ste. Marie, Ontario, resulted in water quality impairment from phenols, ammonia and cyanides.

Concentrations of iron, coliform bacteria and fecal coliforms apparently remained unchanged. Though conclusive statistical evidence is lacking, from the limited sampling it can be stated that their concentrations are probably within the IJC objectives.

Lake Michigan

Available data do not indicate any significant trends in water quality parameters. The southern portion of the lake continued to show contamination from municipal and industrial sources. Elevated concentrations of fecal and total coliform bacteria, phosphorus and other nutrients, mercury and other heavy metals, and phenols were found along the southern shore of the lake. DDT and PCB's continued to be found in salmon and trout at levels which prevent their sale in commercial quantities.

Though the statistical properties of the data were not provided, northern Lake Michigan waters entering the Straits of Mackinac were reported to be of continued high quality.

Lake Huron

No trends are reported for physical, chemical, nutrient, heavy metal, or biological characteristics in the high-quality open lake waters and Georgian Bay, or the polluted waters of Saginaw Bay. An extensive section of the report of the Water Quality Board for 1972 detailed conditions in these bodies of water. Surveys to be undertaken in 1974 as part of the Upper Lakes Reference will provide the basis for future reports.

St. Clair River

1973 conditions showed apparent improvements over those of 1971 because of reductions in spills from oil or petrochemical operations and because of improved controls over phenol discharges from the Sarnia area. The high concentrations of chlorides and other dissolved salts from Dow Chemical and other dischargers in the Sarnia area continue to be a matter for concern as the total dissolved solids in Lake Erie approach the IJC objectives of 200 mg/l.

Lake St. Clair

Reported analyses and interpretations of 1973 and 1971 water quality data from Lake St. Clair do not indicate any statistically significant trends in chemical or bacteriological parameters.

Detroit River

Long-term records on water quality and relatively ambitious sampling programs on Detroit River quality are summarized in Table 2. Municipal and industrial wastes from the Detroit and Windsor areas cause water quality problems. Annual average values suggest reductions in chlorides and phosphorus. It has not been possible to determine the significance of these reductions or of an apparent increase in nitrogen.

Bacteriological quality (not shown on the tables) consistently failed to meet IJC objectives. It is suggested that this was due to storm water runoff; however, information

TABLE 2

WATER QUALITY AT THE MOUTH OF THE DETROIT RIVER

Parameter	Average Concentrations **							
	1966	1967	1968	1969	1970	1971	1972	1973
Phenol (ug/l)	7.5	3.0	2.0	4.0	4.1	1.0	2.1	2.4
Total Iron (mg/l)	0.455	0.813	0.096	0.585	0.533	0.353	0.598	0.471
Chloride (mg/l)	32.5	29.4	27.8	23.3	19.2	21.4	16.4	16.5
Soluble Phosphorus (mg/l)	0.309	0.175	0.072	0.083	0.062	0.036	0.036	0.015
Total Phosphorus (mg/l)	---	---	0.186	0.144	0.133	0.067	0.079	0.058
Ammonia Nitrogen (mg/l)	0.270	0.171	0.134	0.189	0.167	0.148	0.142	0.124
Nitrate Nitrogen (mg/l)	0.080	0.180	0.190	0.212	0.227	0.375	0.275	0.285
pH	7.86	8.16	7.89	7.98	7.93	8.1	7.9	7.9
Dissolved Oxygen (mg/l)	9.5	7.5	8.1	8.5	7.6	8.0	8.5	8.9

** Data from sampling programs carried on by Michigan and Ontario were used to prepare the table shown above. Approximately ten stations across the river were used in calculating the averages.

on seasonal variations or correlations with precipitation to support this suggestion have not been investigated.

Mean values of dissolved oxygen met the IJC objectives of 6.0 mg/l at all stations sampled. However, a few stations in localized areas along the shoreline had occasional values below 6.0 mg/l.

Lake Erie

Both water quality problems and improvements are normally seen in near-shore waters before they are noted in open lake waters. It is, therefore, encouraging to note reductions in phytoplankton and total coliform bacteria at selected water works intakes along the Ohio shores of Lake Erie. This, no doubt, reflects reduction in waste loads discharged as effected by remedial measures placed in operation over the past few years.

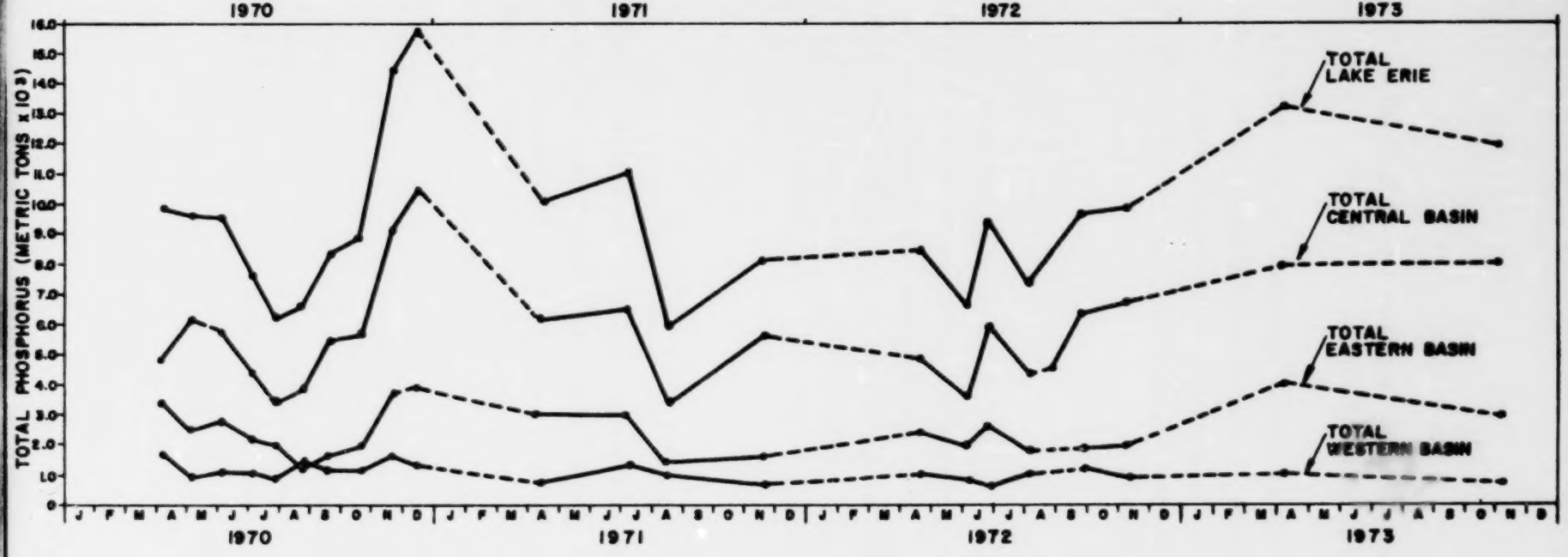
Eutrophication and reduced oxygen levels in Lake Erie have been linked to phosphorus inputs to the lake (see Page 83). Changes in phosphorus levels in the lake then are also a partial measure of the success of phosphorus control programs.

Oxygen depletion in Lake Erie has been a matter of scientific interest since it was first noted in 1930. In that year a value of 0.8 mg/l dissolved oxygen was found in the bottom waters of the central basin of the lake east of Kelley's Island, at a time near the end of the normal summer period of thermal stratification. It is this season in which the lower layer (hypolimnion) is substantially deprived of oxygen supply from the atmosphere. Scientific interest

shifted into public concern when, in 1959, it was found that these deeper waters contained less than 1 mg/l dissolved oxygen, over an area of approximately 4,000 square kilometers. Changes in these summer oxygen levels have been concurrent with increasing algal growths which are indicative of an accelerated eutrophication or aging of the lake due to the activities of man.

Since 1959 the area of observed anoxic layer in late summer has increased substantially, having been observed as large as 6,600 km^2 in 1970 and 11,600 km^2 in 1973. Unfortunately the time of maximum extent of hypolimnetic anoxia varies considerably from year to year in response to weather conditions. Hence,past ship survey techniques could not be expected to define variations very precisely from one year to the next. Oxygen depletion rates in terms of rates of concentration changes are also sufficiently variable that no conclusive evidence has yet been presented for change between 1970 and 1973.

As the search for unambiguous parameters to define the degree of eutrophication proceeds, an analysis of total phosphorus data from ship surveys of Lake Erie from 1970 to 1973 has been undertaken. The results are shown in Figure 1. It is deemed probable that total phosphorus content of lake waters, in the absence of significant bottom stirring, will be such a measure. Large increases in phosphorus in November 1970 are attributed to storm stirring of the bottom. The higher values in early 1973 may be due to bottom stirring by winter storms. Normal winter ice cover usually prevents this occurrence, but the 1972-73 winter was unusually mild and as a result the lake had a much less than normal ice cover. When these points are withdrawn



SOURCE: N.M. BURNS, C.H. CHAN AND F. ROSA, UNPUBLISHED DOCUMENT, "PRELIMINARY REPORT ON SOME CHEMICAL PARAMETERS IN LAKE ERIE DURING 1973", CANADA CENTRE FOR INLAND WATERS, 1974

QUANTITIES OF TOTAL PHOSPHORUS IN LAKE ERIE 1970-1973

FIG. 1

from consideration there is some appearance of a slight trend towards increasing total phosphorus content.

In summary, there is no clear evidence of substantial improvement or degradation in the period 1970 to 1973, and this is believed to be consistent with stabilization of phosphorus loading values-averaged over the flushing time of the lake (about 3 years).

Niagara River

A major report on the Niagara River appears in a previous report of the Commission. Discharges of municipal and industrial wastes, particularly from the Niagara Falls and Buffalo areas, continue to cause problems due to phenols, iron, and bacteriological contamination. Available data and reports do not indicate trends or variations in concentration levels.

Lake Ontario

Inspection of 1973 water quality data for Lake Ontario reveals no substantial change from 1971 conditions in either the open lake or the polluted coastal areas of Niagara County, Rochester, Black River Bay, and Oswego Harbor in New York State or Hamilton Bay, and Toronto Harbor in Ontario.

St. Lawrence River

Annual average flows in 1973 were unusually high and exceeded by 16 percent the 1971 flows. At the same time, reported average phosphorus concentrations were reduced by

an estimated 10 to 30 percent; total coliform densities increased 10- to 100- fold, and fecal coliform levels remained essentially unchanged. Variability in other constituents and statistical significance of levels or changes in concentrations have not been established.

PERSISTENT CONTAMINANTS IN FISH IN THE GREAT LAKES

The need for data on the levels and effects of a variety of persistent contaminants in the Great Lakes environment has become increasingly evident in recent years. Most State and Provincial environmental agencies have responded to this need by instituting surveillance programs to monitor levels of mercury, chlorinated hydrocarbons and their residues, and, more recently, PCB's in the water, sediment and biota of the Great Lakes. As most of these monitoring data have not been provided, it is impossible to forecast changing trends of chemical contamination of the fish of the Great Lakes.

Mercury Concentrations in Fish

The discovery of high concentrations of mercury in fish caught in Lake St. Clair and the western basin of Lake Erie prompted resource authorities to ban commercial fishing in these areas and to develop regulations to virtually eliminate the discharge of mercury into the lakes via industrial effluents. Monitoring programs were initiated to assess the concentrations of mercury in fish throughout the Great Lakes.

Table 3 shows the mean values of mercury for selected species of fish for the Great Lakes (with the exception of

Lake Michigan). These data were collected in 1971.

TABLE 3

MEAN CONCENTRATIONS OF MERCURY
Found in Selected Species of Fish in the Great Lakes

	Mean Concentrations of Mercury (ppm)				
Species	Superior	Huron	St. Clair	Erie	Ontario
Pickerel	0.49	0.61	2.46	0.53	0.62
Lake trout	0.66	N.A.	N.A.	N.A.	N.A.
Whitefish	0.39	0.08	N.A.	N.A.	0.12
Yellow perch	0.47	0.28	2.11	0.28	0.38
Pike	0.55	0.42	1.85	0.55	0.51
Bass[1]	N.A.[2]	0.92	2.40	0.57	0.48

1. Includes rock bass, white bass, smallmouth bass and largemouth bass.
2. Not analyzed.

Recent data indicate that concentrations of mercury in fish in some areas have not changed significantly since 1971. Limited sampling data from central Lake Superior (Marathon) indicate that significant concentrations of mercury exist in pike, whitefish, lake trout, and brook trout.

The mercury concentrations have been generally high in fish collected from Lake St. Clair. It is encouraging to note that very recent data from the Great Lakes Fishery Laboratory of the U.S. Department of the Interior indicates that the rate of accumulation of mercury in fish from Lake St. Clair is decreasing. Present mercury concentrations in rock bass, perch,

walleye and catfish of a certain size range from Lake St. Clair have decreased by an average of 60 per cent (from 1 ppm to less than 0.5 ppm between 1970 and 1973) when compared to concentrations in fish of a similar size range captured in 1970. This decrease has been attributed to the elimination of industrial discharges of mercury.

Mercury concentrations in Lake Michigan fish are reported to be "generally low". Monitoring of levels of mercury in water reveals no significant trends in Lake Michigan.

Chlorinated Hydrocarbon Concentrations in Fish

While monitoring for pesticide residues in fish, sediments and waters of the Great Lakes has been conducted by a number of agencies, limited data on concentrations of chlorinated hydrocarbons has been made available. These limited data indicate a continuation of a declining trend in DDT concentrations in fish from Lake Michigan. Between 1970 and 1972, the levels of DDT in Lake Michigan chub, for instance, have reportedly decreased from over 10 ppm to less than 5 ppm, the tolerance level established by the Food and Drug Administration. Levels of DDT in lake trout and salmon from Lake Michigan decreased from 19 ppm to 12 ppm, and 14 ppm to 7 ppm, respectively. These downward trends are expected to continue due to bans on the use of DDT imposed in Wisconsin and Michigan.

A document prepared for the IJC in 1972 reported the contamination of the aquatic environment of the Great Lakes by PCB's (polychlorinated biphenyls). Concentrations of PCB's in the water, sediment, invertebrates, plankton

and fish were monitored. Levels detected in the sediment ranged from 20 - 480 parts per billion (ppb). These residues are approximately 1000 times the concentration of PCB's observed in the water and confirm that significant quantities of these contaminants accumulate at the bottom of the lakes. The proposed criterion (0.010 ppb) for PCB's in the water was exceeded in 60 - 70 percent of the water samples taken from lakes Erie and Ontario. This is particularly significant as these levels may be sufficiently high in the Great Lakes Basin to adversely affect reproduction in fish.

During 1970 and 1971, PCB concentrations in fish in Lake Erie ranged from 0.2 - 4.7 ppm, with catfish having the highest residues (1.4 - 4.7). In Lake Michigan, chinook salmon (14.5), lake trout (14.3) and coho salmon (11.9) were most highly contaminated. Red sucker and smelt did not exceed the U.S.F.D.A. criterion of 5 ppm. Data suggest that the southern portion of Lake Michigan is more highly contaminated than the northern portion. Fish from lakes Huron, Ontario and St. Clair were analyzed for PCB contamination in 1972. Levels of PCB in the edible portions of the fish were generally below 5 ppm, with the exception of whitefish and pike from St. Clair River and coho salmon from Lake Ontario. An investigation of whitefish from Lake Erie revealed that the concentration of PCB's approached, but did not exceed, 5 ppm.

Additional research is necessary to determine the environmental significance of observed levels of PCB's in the biota and to evaluate human health implications.

REQUIREMENTS FOR UTILIZATION OF GREAT LAKES WATER QUALITY DATA

The water quality and surveillance study programs from which the preceding findings were derived are major and important activities. Other data bases exist but have not been included for various reasons. These include the 1972-73 International Field Year for the Great Lake (IFYGL) data on Lake Ontario for which large portions of U.S. data have not yet been released, and results of the U.S. Public Health Service studies (during the mid-1960's) of lakes Michigan, Huron, Erie and Ontario either in raw or summarized form.

Privately and publicly supported university research data has also been excluded from consideration. Recognizing that there are many areas for which basic data are required, there is a very strong need to evaluate existing historical and current information in a unified program directed by the the IJC. Such a program must include: coordination of sampling and parameters measured; analytical quality control; data storage, retrieval and routine analysis procedures. It should also include utilization of the data through compatible interpretation, submission, and exchange procedures. Present practices for managing Great Lakes water quality data have given rise to concerns expressed by participating agencies such as those made in connection with the Lake Erie and the Detroit River portions of this chapter.

For example, present surveillance programs and allocation of resources for data analysis limit the confidence with which Detroit River water quality data can be related to remedial program accomplishments. In view of these limitations, authorities responsible for the preparation of Table 2

have cautioned that, "No attempt has been made to statistically analyze the year-to-year changes in these concentrations or to compensate for the effect of varying flow rates. Differences in concentrations of some parameters such as phenol are probably not statistically significant. However, the reductions in chloride and phosphorus probably are significant." Hence it is clear that substantial elements of judgement remain in these assessments.

Basic procedures for the submission and exchange of information have been adopted in turn by the GLWQB, the Commission and Governments. These procedures need to be broadened and implemented by an IJC co-ordinated monitoring program in which details of data collection and utilization will be standardized. The purpose of this program would be to provide statistically valid trend information for relevant and representative parameters reflecting the state of ambient water quality as it pertains to natural conditions and management.

REMEDIAL PROGRAMS

MUNICIPAL PROGRAMS

It is generally considered that both the U.S. and Canadian programs for the abatement and control of municipal discharges to the Great Lakes Basin are adequate to achieve the water quality objectives as outlined by the Agreement. However, because of many unforeseen delays, particularly in the United States, it is extremely unlikely that the implementation and completion of these programs will meet the 1975 deadline as specified in the Agreement.

In order to make a satisfactory comparison of the accomplishments of both parties under the Agreement, a common denominator is necessary. Because of differences in requirements and definitions of degree of treatment in the various jurisdictions, the term "adequate treatment" is used in reporting on programs that relate to the International Agreement.

a. Adequate treatment for the U.S. is defined as: a minimum of secondary treatment with 85 percent removal of BOD and suspended solids (SS), disinfection, and a total phosphorus reduction of 80 percent for each basin. Compliance with the last stipulation generally requires an effluent reduction to the range of 0.5 to 1.0 mg/l.

b. In general, adequate treatment for Ontario means a minimum of secondary treatment or equivalent. (in practice 20 mg/l BOD and Suspended Solids in the treated effluent). On major waterways, adequate treatment may comprise primary with supplementary chemical treatment for removal of nutrients and organic material depending upon sewage characteristics, plant location, and receiving stream conditions. By 1975, adequate treatment in the Lower Lakes area will include phosphorus removal to a level of 1.0 mg/l or less. The program for phosphorus removal throughout the Upper Lakes basin will await the results of the current Upper Lakes study.

The two definitions of adequate treatment result from different approaches to the control of pollution of waterways in each country. Canada requires that the treatment of waste discharged to the waterways be adequate to prevent pollution of individual receiving streams. This could be primary, secondary or advanced treatment according to the effects on water quality in each case.

In the United States statutory and regulatory objectives require a minimum of secondary treatment (regardless of water quality) with advanced treatment where necessary to meet water quality standards. This approach was strengthened and re-emphasized in PL 92-500, October 18, 1972, which states as one of its objectives "it is the national goal that the discharge of pollutants into the navigable waters be eliminated by 1985:..."

Public Law 92-500 also requires that an NPDES Permit be issued to each municipal discharger setting forth a schedule for secondary treatment by July 1, 1977, and best practicable technology by 1983. Secondary treatment as currently defined in the U.S. consists of limiting the concentration as follows:

	DAILY AVERAGE	MAXIMUM
BOD	30 mg/l	45 mg/l
SS	30 mg/l	45 mg/l
Fecal Coliform	200/100 ml	400/100 ml

Accomplishments by Jurisdiction

The following comparisons comprise an evaluation of progress in meeting the scheduled construction of facilities that at the signing of the Agreement were considered necessary to provide treatment adequate to meet the water quality objectives. (See Table 4)

CANADA

By the end of 1971, 77 percent of the 4.8 million population on sewers in the Province of Ontario portion of the Great Lakes Basin were served by facilities providing a minimum of secondary treatment or its equivalent. Only five of the 349 municipal systems were not equipped with treatment; another 171 provided an intermediate level of treatment, and the remaining 173 provided secondary treatment.

At December 1973 only four sources remained untreated. The number providing partial treatment was reduced to 155,

TABLE 4

MUNICIPAL REMEDIAL PROGRAMS
(BY JURISDICTION)

JURISDICTION	TOTAL NO. OF MUN. PLANTS	SEWERED POPULATION	STATUS 1971 NT	PT	AT *	% **	ACCOMPLISHMENTS 1973 NT	PT	AT *	% **	PROJECTIONS 1975 NT	PT	AT *	% **	EXPENDITURES 1971 - 1973*** For Treatment Plants	Other System Expenditures
ONTARIO																
Lake Superior****	10	121,000	1	5	4	76	1	5	4	76	1	1	8	79	300,000	1,940,000
St. Mary's River****	2	76,000	0	1	1	96	0	1	1	96	0	0	2	100	1,530,000	
Lake Huron****	106	370,000	2	49	55	76	2	45	59	99	2	0	104	99	16,900,000	15,800,000
St. Clair River & Detroit River	40	501,000	0	26	14	64	0	24	16	65	0	0	40	100	9,100,000	12,820,000
Lake Erie	75	444,000	1	40	34	97	1	34	40	98	0	5	70	98	11,000,000	4,900,000
Niagara River	4	107,000	0	3	1	4	0	2	2	39	0	0	4	100	2,950,000	6,220,000
Lake Ontario	97	3,081,000	0	36	61	87	0	32	65	88	0	1	96	99	125,600,000	44,500,000
St. Lawrence River	15	136,000	1	10	4	7	0	11	4	7	0	1	14	72	153,000	1,550,000
Subtotal	349	4,836,000	5	171	173	80	4	155	190	84	3	8	338	98	167,533,000	87,730,000
															$255,263,000	

**** Adequacy of Treatment to be reviewed in Upper Lakes Reference Study

TABLE 4

MUNICIPAL REMEDIAL PROGRAMS

(BY JURISDICTION)

JURISDICTION	TOTAL NO. OF MUN. PLANTS	SEWERED POPULATION	STATUS 1971				ACCOMPLISHMENTS 1973				PROJECTIONS 1975				EXPENDITURES 1971 - 1973***	
			NT	PT	AT *	% **	NT	PT	AT *	% **	NT	PT	AT *	% **	For Treatment Plants	Other System Expenditures
ILLINOIS																
Lake Michigan	7	200,000	0	5	2	80	0	3	4	85	0	0	7	100	64,400,000	
Subtotal	7	200,000	0	5	2	80	0	3	4	85	0	0	7	100	64,400,000	
															64,000,000	
INDIANA																
Lake Erie	7	212,000	0	7	0	0	0	3	4	94	0	0	7	100	8,925,000	
Lake Michigan	11	612,800	0	11	0	0	0	3	8	51	0	0	11	100		
															8,925,000	
															8,925,000	

Number of Plants

AT = Adequate Treatment

PT = Partial Treatment

NT = No Treatment

* Adequate Treatment is defined on page 41

** Percentage of sewered population served by adequate treatment facilities.

*** Canada - Funds awarded. U.S. - Funds expended.

TABLE 4

MUNICIPAL REMEDIAL PROGRAMS
(BY JURISDICTION)

JURISDICTION	TOTAL NO. OF MUN. PLANTS	SEWERED POPULATION	STATUS 1971				ACCOMPLISHMENTS 1973				PROJECTIONS 1975				EXPENDITURES 1971 - 1973***	
			NT	PT	AT *	% **	NT	PT	AT *	% **	NT	PT	AT *	% **	For Treatment Plants	Other System Expenditure
MICHIGAN																
Lake Superior	31	62,000	10	15	6	53	5	14	12	55	2	8	21	81	890,000	
Lake Michigan	100	1,157,000	42	91	47	6	13	66	101	30	0	45	135	63	43,062,000	13,665,000
St. Mary's River	1	18,000	0	1	0	0	0	1	0	0	0	1	0	0	-	-
Lake Huron	82	714,000	25	45	12	2	3	36	43	26	1	21	60	87	9,053,000	-
St. Clair River & Lake St. Clair	29	400,000	1	25	3	2	0	23	6	5	0	14	15	92	39,489,000	6,915,000
Detroit River	6	3,400,000	0	6	0	0	0	5	1	1	0	4	2	8	87,620,000	-
Lake Erie	43	331,000	1	23	19	12	0	18	25	24	0	16	27	25	5,251,000	500,000
Subtotal	372	6,082,000	79	206	87	2.7	21	163	188	11.5	3	109	260	35	185,365,000	21,080,000
															206,445,000	

TABLE 4

MUNICIPAL REMEDIAL PROGRAMS

(BY JURISDICTION)

JURISDICTION	TOTAL NO. OF MUN. PLANTS	SEWERED POPULATION	STATUS 1971				ACCOMPLISHMENTS 1973				PROJECTIONS 1975				EXPENDITURES 1971 - 1973***	
			NT	PT	AT *	% **	NT	PT	AT *	% **	NT	PT	AT *	% **	For Treatment Plants	Other System Expenditures
MINNESOTA																
Lake Superior	36	150,000	2	34	0	0	0	34	2	7	0	29	7	30	540,000	50,000
Subtotal	36	150,000	2	34	0	0	0	34	2	7	0	29	7	30	540,000	50,000
															590,000	
NEW YORK																
Lake Erie	24	90,300	0	13	11	5	0	11	13	24	0	8	16	68	17,100,000	
Niagara River	29	1,287,600	0	21	8	2	0	21	8	2	0	9	20	16	220,800,000	
Lake Ontario	130	1,312,300	1	91	38	8	1	48	81	21	0	38	92	62	133,700,000	
St. Lawrence River	21	70,900	0	14	7	4	0	5	16	51	0	5	16	51	1,800,000	
Subtotal	204	2,761,100	1	139	64	5	1	85	118	13	0	60	144	38	373,400,000	

Number of Plants

AT = Adequate Treatment

PT = Partial Treatment

NT = No Treatment

* Adequate Treatment is defined on page 41

** Percentage of sewered population served by adequate treatment facilities.

*** Canada - Funds awarded. U.S. - Funds expended.

TABLE 4

MUNICIPAL REMEDIAL PROGRAMS
(BY JURISDICTION)

JURISDICTION	TOTAL NO. OF MUN. PLANTS	SEWERED POPULATION	STATUS 1971				ACCOMPLISHMENTS 1973				PROJECTIONS 1975				EXPENDITURES 1971 - 1973***	
			NT	PT	AT *	% **	NT	PT	AT *	% **	NT	PT	AT *	% **	For Treatment Plants	Other System Expenditure
OHIO																
Lake Erie	245	3,101,000	7	62	176	9	7	39	199	68	6	38	201	76	138,156,900	
Subtotal	245	3,101,000	7	62	176	9	7	39	199	68	6	38	201	76	138,156,900	
															138,156,900	
PENNSYLVANIA																
Lake Erie	7	222,900	0	7	0	0	0	6	1	76	0	0	7	100	18,260,000	
Subtotal	7	222,900	0	7	0	0	0	6	1	76	0	0	7	100	18,260,000	
															18,260,000	
WISCONSIN																
Lake Superior	5	47,100	0	5	0	0	0	2	3	26	0	0	5	100	3,113,500	
Lake Michigan	52	1,932,000	0	46	6	2	0	18	34	70	0	0	52	100	79,480,700	20,153,700
Subtotal	57	1,979,100	0	51	2	2	0	20	37	96	0	0	57	100	82,594,200	20,153,700
															102,747,900	

TABLE 4

MUNICIPAL REMEDIAL PROGRAMS
(BY JURISDICTION)

JURISDICTION	TOTAL NO. OF MUN. PLANTS	SEWERED POPULATION	STATUS 1971				ACCOMPLISHMENTS 1973				PROJECTIONS 1975				EXPENDITURES 1971 - 1973***	
			NT	PT	AT *	% **	NT	PT	AT *	% **	NT	PT	AT *	% **	For Treatment Plants	Other System Expenditures
TOTAL GREAT LAKES SYSTEM																
Canada	349	4,836,000	5	171	173	80	4	155	190	84	3	8	338	98	255,263	000
United States	946	15,320,000	89	522	335	5	29	356	561	35	9	236	701	58	912,924	800
TOTAL	1,295	20,156,000	94	693	508	23	33	511	751	47	12	244	1039	68	1,168,187	800

Number of Plants
AT = Adequate Treatment
PT = Partial Treatment
NT = No Treatment

* Adequate Treatment is defined on page 41
** Percentage of sewered population served by adequate treatment facilities.
*** Canada - Funds awarded. U.S. - Funds expended.

while the number of projects providing an adequate level of treatment increased to 190. This brought the proportion of sewered population in the basin served with adequate facilities to 81 percent. Over the 1971-73 period, 16 new plants were built. Thirty-three plants were either expanded or improved and 91 trunk sewer projects were commenced. During that same period funds committed to treatment and trunk sewer projects to be completed by 1975 totalled $255 million of which $183 million was spent. Another $125 million is expected to be committed in 1974 and 1975 for the construction of major projects in those years. Municipal sewer projects for lateral and collector sewers comprise additional expenditures.

The expectations of the program by 1975 are shown in Table 4. Of the four municipalities not expected to have completed sewage treatment projects by 1975, Thunder Bay and Red Rock are anticipated to be concluded in 1976. Completion of the project for Blind River has been delayed until 1977, and further development of the Thessalon project will await the outcome of enforcement action.

With the exception of these projects, the backlog of basic municipal sewage problems in the Great Lakes Basin will have been overcome. Completion of these projects will depend on further engineering work, but can be expected to proceed to early conclusion. By 1975 a residual of eight projects is expected to provide only intermediate level treatment; however, better than 95 percent of the sewered population in the basin is expected to be served with adequate sewage treatment. Continuing expenditures on sewage system renewals and improvements and capacity and treatment adjustments can be expected in future years.

UNITED STATES

In the Great Lakes Basin states, 89 municipalities of the 946 identified in the Great Lakes Basin had no treatment as of December 31, 1971. By December 1973 only 29 municipal plants had no treatment and the sewered population served by adequate treatment increased from 5 percent in 1971 to 35 percent in 1973. Facilities with adequate treatment increased from 335 in 1971 to 561 in 1973. During the period from 1971 to 1973 expenditures for new wastewater treatment facilities, additional treatment at existing facilities and collection systems totalled over $913 million. As indicated in Table 4, it is anticipated that by 1975 only 9 municipalities will have no treatment and 58 percent of the 15.3 million sewered population will be treated adequately by 701 facilities.

The states of Illinois, Indiana, Pennsylvania and Wisconsin anticipate that 100 percent of the sewered population will be treated adequately by 1975. The remaining jurisdictions have major facilities which will come on line after the December 31, 1975. In Michigan, the Detroit Metropolitan Regional facility is expected to be operational by July 1976, and will increase the percent of population which would be adequately treated in the Detroit River, St. Clair River and Lake St. Clair Basin from 8 percent to approximately 100 percent. This one facility will also have a dramatic impact on Michigan's overall treatment status. The Western Lake Superior Sanitary District (WLSSD), Duluth, Minnesota, which includes 9 municipalities, is expected to be completed by 1976. It will substantially increase the percent of adequate treatment for Lake Superior. When on line,

the major metropolitan facilities of Buffalo, (1979) Niagara Falls, (1976) and the Tonawandas (1976-77) in the Niagara River Basin should increase the percent of population receiving adequate treatment from 16 percent to approximately 95 percent. Adequate treatment in New York's Lake Ontario Basin will approach 90 percent of the sewered population when by 1979 the facility of metropolitan Syracuse is put into operation. The Cleveland Regional Sewer District in the Ohio Lake Erie Basin will be partially completed in 1976 and fully operational by 1978. When this project is completed nearly 100 percent of the Ohio sewered population in the Lake Erie Basin will be served by adequate treatment.

Accomplishments and Projections by Basin

The status of the municipal remedial programs being implemented in each of the Great Lakes Basins and major connecting channels is presented in Table 5. The percentage of sewered population served by adequate wastewater treatment facilities is summarized in Figure 2 for the Total Great Lakes System and in Figure 3 for each of the lakes and major rivers.

Overall the Lake Superior Basin has a sewered population of 380,100 in 82 communities in both countries. In 1971, 25 percent of the sewered population received adequate treatment. By 1973 this figure increased to 31 percent and based upon present requirements, it is expected to reach 50 percent by 1975.

The St. Marys River Basin has three communities with a total sewered population of 94,000. Based on present evaluations, by 1975 the two Canadian communities serving 81 percent of the total population will have "adequate"

TABLE 5

MUNICIPAL REMEDIAL PROGRAMS
(BY GREAT LAKES BASIN)

BASIN	TOTAL NO. OF MUN. PLANTS	SEWERED POPULATION	STATUS 1971 NT	PT	AT *	% **	ACCOMPLISHMENTS 1973 NT	PT	AT *	% **	PROJECTIONS 1975 NT	PT	AT *	% **	EXPENDITURES 1971 - 1973 *** For Treatment Plants	Other System Expenditures
LAKE SUPERIOR																
Canada ****	10	121,900	1	5	4	76	1	5	4	76	1	1	8	79	300,000	1,940,000
United States	72	259,100	12	54	6	1.3	5	50	17	10	2	37	33	37	4,543,500	50,000
	82	380,100	13	59	10	25	6	55	21	31	3	38	41	50	4,843,500	1,990,000
															6,833,500	
ST MARY'S RIVER																
Canada ***	2	76,000	0	1	1	96	0	1	1	96	0	0	2	100	1,530,000	-
United States	1	18,000	0	1	0	0	0	1	0	0	0	1	0	0	-	-
Subtotal	3	94,000	0	2	1	78	0	2	1	78	0	1	2	81	1,530,000	
															1,530,000	
LAKE MICHIGAN																
United States	250	3,901,800	42	153	55	7	13	90	147	56	0	45	205	89	195,867,700	33,818,700
Subtotal	250	3,901,800	42	153	55	7	13	90	147	56	0	45	205	89	229,686,400	

Number of Plants
AT = Adequate Treatment
PT = Partial Treatment
NT = No Treatment

* Adequate Treatment is defined on page 41
** Percentage of sewered population served by adequate treatment facilities.
*** Canada - Funds awarded. U.S. - Funds expended.
**** Adequacy of Treatment to be reviewed in Upper Lakes Reference Study.

TABLE 5

MUNICIPAL REMEDIAL PROGRAMS
(BY GREAT LAKES BASIN)

BASIN	TOTAL NO. OF MUN. PLANTS	SEWERED POPULATION	STATUS 1971 NT	PT	AT *	% **	ACCOMPLISHMENTS 1973 NT	PT	AT *	% **	PROJECTIONS 1975 NT	PT	AT *	% **	EXPENDITURES 1971 - 1973*** For Treatment Plants	Other System Expenditures
LAKE HURON																
Canada ****	106	370,000	2	49	55	76	2	45	59	99	2	0	104	99	16,900,000	15,800,000
United States	82	714,000	25	45	12	2	3	36	43	26	1	21	60	87	9,053,000	-
Subtotal	188	1,084,000	27	94	67	27	5	81	102	51	3	21	164	91	25,953,000	15,800,000
															41,753,000	
ST. CLAIR RIVER, LAKE ST. CLAIR & DETROIT RIVER																
Canada	40	501,000	0	26	14	64	0	22	18	95	0	0	40	100	9,100,000	12,820,000
United States	35	3,800,000	1	31	3	0.2	0	28	7	1.4	0	18	17	17	127,109,000	6,915,000
Subtotal	75	4,301,000	1	57	17	8	0	52	23	13	0	18	57	27	136,209,000	19,735,000
															155,944,000	

TABLE 5

MUNICIPAL REMEDIAL PROGRAMS
(BY GREAT LAKES BASIN)

BASIN	TOTAL NO. OF MUN. PLANTS	SEWERED POPULATION	STATUS 1971				ACCOMPLISHMENTS 1973				PROJECTIONS 1975				EXPENDITURES 1971 - 1973***	
			NT	PT	AT *	% **	NT	PT	AT *	% **	NT	PT	AT *	% **	For Treatment Plants	Other System Expenditures
LAKE ERIE																
Canada	75	444,000	1	40	34	97	1	34	40	98	0	5	70	98	11,000,000	4,900,000
United States	326	3,957,200	8	112	206	8	7	77	242	65	6	62	258	74	178,767,900	500,000
	401	4,401,200	9	152	240	17	8	111	282	68	6	67	328	76	189,767,900	5,400,000
															195,167,900	
NIAGARA RIVER																
Canada	4	107,000	0	3	1	4	0	2	2	39	0	0	4	100	2,950,000	6,220,000
United States	29	1,287,600	0	21	8	2	0	21	8	2	0	9	20	16	220,800,000	-
	33	1,394,600	0	24	9	2	0	23	10	5	0	9	24	22	223,750,000	6,220,000
															229,970,000	

Number of Plants
AT = Adequate Treatment
PT = Partial Treatment
NT = No Treatment

* Adequate Treatment is defined on page 41
** Percentage of sewered population served by adequate treatment facilities.
*** Canada - Funds awarded. U.S. - Funds expended.

TABLE 5

MUNICIPAL REMEDIAL PROGRAMS
(BY GREAT LAKES BASIN)

BASIN	TOTAL NO. OF MUN. PLANTS	SEWERED POPULATION	STATUS 1971				ACCOMPLISHMENTS 1973				PROJECTIONS 1975				EXPENDITUPES 1971 - 1973***	
			NT	PT	AT *	% **	NT	PT	AT *	% **	NT	PT	AT *	% **	For Treatment Plants	Other System Expenditures
LAKE ONTARIO																
Canada	97	3,081,000	0	36	61	87	0	32	65	88	0	1	96	99	125,600,000	44,500,000
United States	130	1,312,300	1	91	38	8	1	48	81	21	0	38	92	62	133,700,000	-
Subtotal	227	4,393,300	1	127	99	63	1	80	146	68	0	39	188	88	259,300,000	44,500,000
															303,800,000	
ST. LAWRENCE RIVER																
Canada	15	136,000	1	10	4	7	0	11	4	7	0	0	15	100	153,000	1,550,000
United States	21	70,000	0	14	7	4	0	5	16	51	0	5	16	51	1,800,000	-
	36	206,000	1	24	11	6	0	16	20	22	0	5	31	83	1,953,000	1,550,000
															3,503,000	

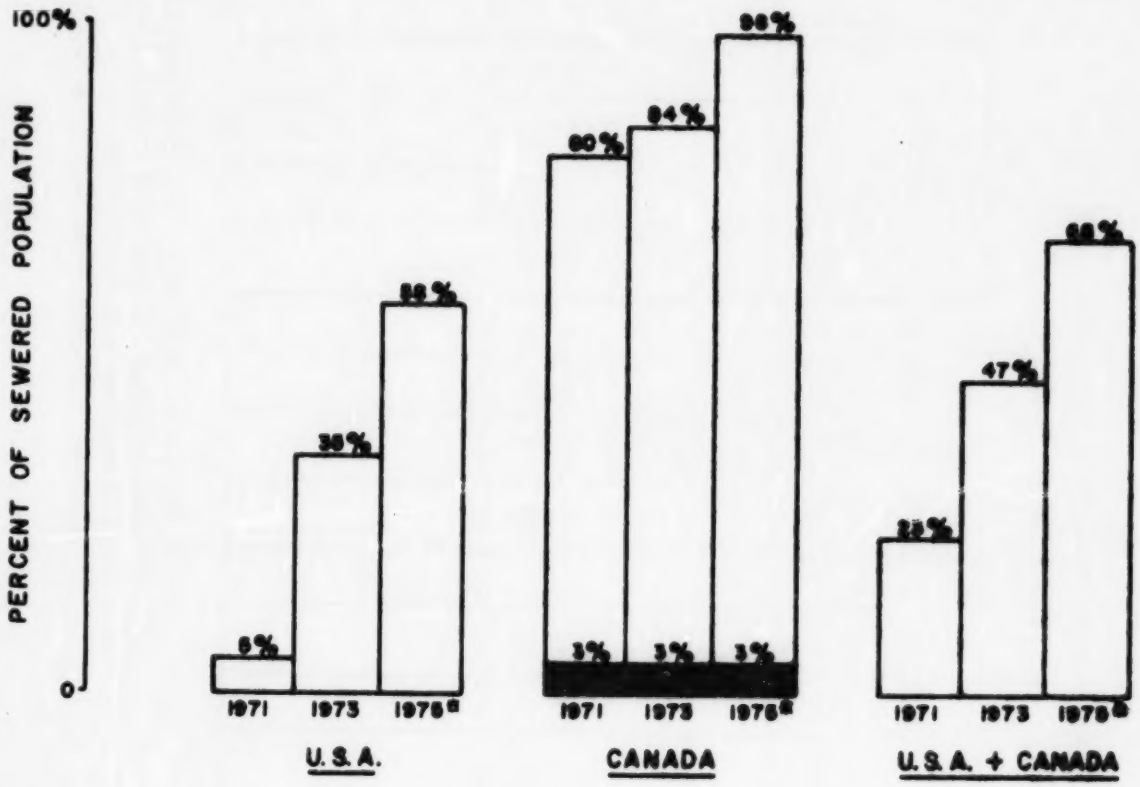
TABLE 5

MUNICIPAL REMEDIAL PROGRAMS
(BY GREAT LAKES BASIN)

BASIN	TOTAL NO. OF MUN. PLANTS	SEWERED POPULATION	STATUS 1971				ACCOMPLISHMENTS 1973				PROJECTIONS 1975				EXPENDITURES 1971 - 1973***	
			NT	PT	AT *	% **	NT	PT	AT *	% **	NT	PT	AT *	% **	For Treatment Plants	Other System Expenditures
TOTAL GREAT LAKES SYSTEM																
Canada	349	4,836,000	5	171	173	80	4	155	190	84	3	8	338	98	255,263,000	
United States	946	15,320,000	89	522	335	5	29	356	561	35	9	236	701	58	912,924,800	
TOTAL	1,295	20,156,000	94	693	508	23	33	511	751	47	12	244	1039	68	1,168,187,800	

Number of Plants
AT = Adequate Treatment
PT = Partial Treatment
NT = No Treatment

* Adequate Treatment is defined on page 41
** Percentage of sewered population served by adequate treatment facilities.
*** Canada - Funds awarded. U.S. - Funds expended.

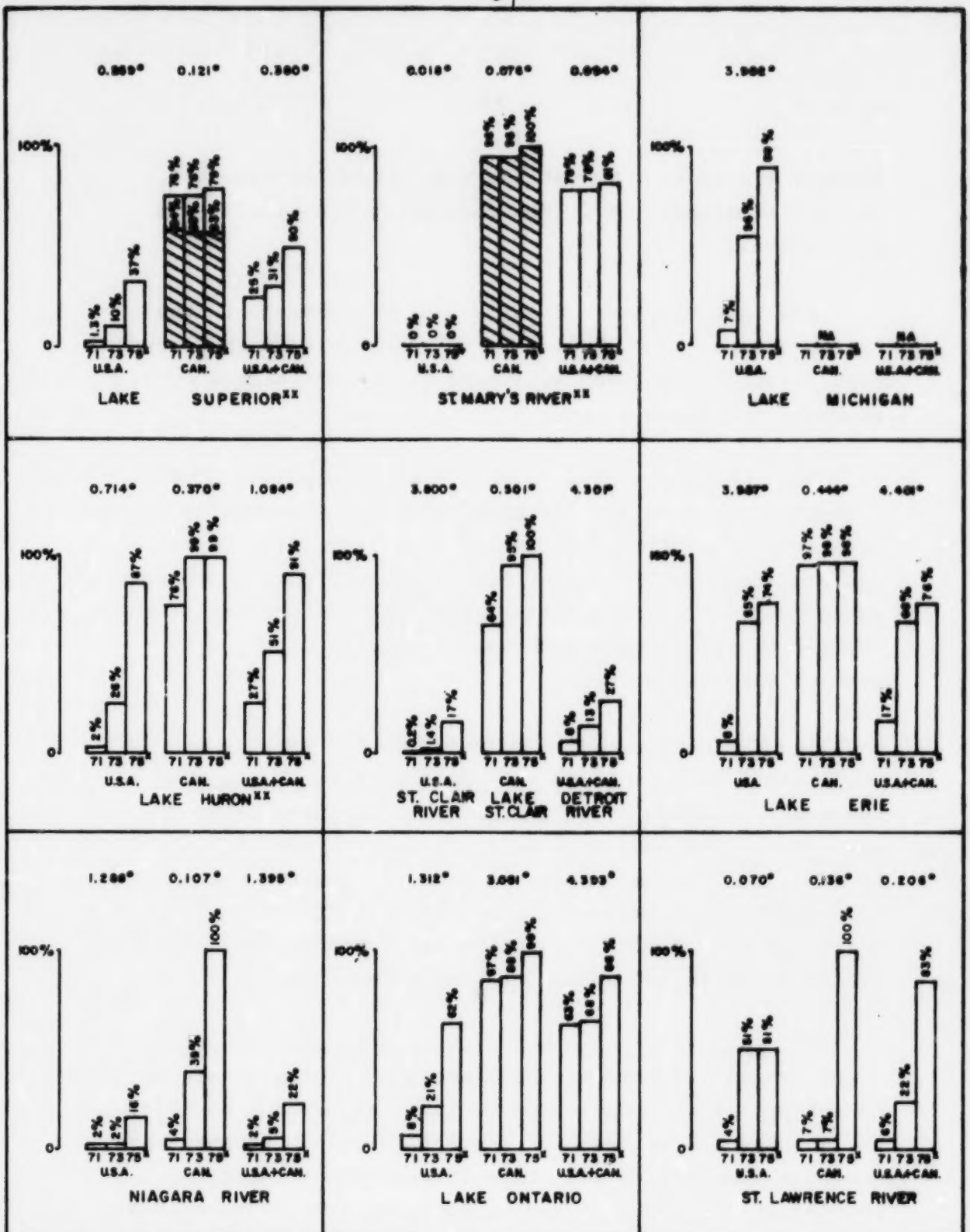


PERCENTAGE OF SEWERED POPULATION SERVED BY ADEQUATE TREATMENT* IN THE GREAT LAKES SYSTEM

*ADEQUATE TREATMENT (See p. 41)

U. S. – Secondary and P-removal
CAN. – Varies with receiving water

FIG. 2



PERCENTAGE OF SEWERED POPULATION IN EACH OF THE GREAT LAKES BASINS AND CONNECTING CHANNELS SERVED BY ADEQUATE TREATMENT

FIG. 3

primary treatment. Though the U.S. community also has primary treatment, it is not considered adequate by U.S. regulations.

The Lake Michigan Basin is located entirely in the United States. Two hundred-fifty communities with a sewered population of 3,901,800 will have 89 percent served by adequate treatment in 1975.

The Lake Huron Basin with a sewered population of 1,084,000 in 188 communities had 27 percent served by adequate treatment in 1971, 51 percent in 1973. In 1975, it is expected to have 91 percent of the sewered population served by adequate facilities. This represents 99 percent of the sewered Canadian population and 87 percent of the U.S. sewered population.

There are 40 Canadian communities and 35 U.S. communities in the St. Clair - Detroit River Basin with a sewered population of 4,301,000. The Canadian sewered population (501,000) will have 100 percent adequate treatment by 1975. Seventeen percent of the U.S. sewered population (3,800,000) will have adequate treatment by 1975. Over 3 million of the U.S. population is served by the Detroit system which is scheduled for completion in 1976.

The Lake Erie Basin has a sewered population of 4,401,200 in 401 communities. Adequate treatment served 17 percent of the population in 1971, 68 percent in 1973, and is expected to reach 76 percent in 1975. Seventy-five Canadian communities will have 98 percent of their population (444,000) served by adequate treatment in 1975; 326 communities on the U.S. side will have 74 percent of

their population (3,957,200) served by adequate treatment.

In the Niagara River Basin by 1975, 100 percent of the Canadian sewered population of 107,000 in 4 communities is expected to be served by adequate treatment; 16 percent of the U.S. sewered population of 1,287,600 in 29 communities will receive adequate treatment.

The Lake Ontario Basin has a sewered population of 4,393,300 in 227 communities. Of this population 63 percent received adequate treatment in 1971, 68 percent in 1973, and an 88 percent are expected to by 1975. Adequate treatment is expected to be provided for 99 percent of the Canadian population (3,081,000) and 62 percent of the U.S. population (1,312,300) by 1975.

The sewered population of the St. Lawrence River Basin is 206,000 located in 36 communities. Adequate treatment was provided to 6 percent of the population in 1971, 22 percent in 1973 and is expected to reach 65 percent by 1975. On the Canadian side (136,000 sewered population in 15 communities) adequate treatment is expected to be provided for 100 percent of the sewered population. The sewered population on the U.S. side (70,000 in 21 communities) will have 51 percent of the population served by adequate treatment in 1975.

Sewer systems serve a population of 20,156,000 in the Great Lakes Basin. Adequate treatment was provide for 23 percent in 1971, 47 percent in 1973 and is expected to reach 68 percent of the sewered population in 1975.

In Canada 349 municipal systems serving a population of 4,836,000 provided adequate treatment for 77 percent of the population in 1971, 88 percent in 1973, and will reach 98 percent in 1975. In the United States 946 municipal systems serving a population of 15,320,000 provided adequate treatment for 5 percent of the population in 1971, 35 percent in 1973, and will reach 58 percent by 1975.

Delays

In the United States, the passage of Public Law 92-500 in 1972 imposed some dramatic changes on the pollution control programs. These modifications will result in a much higher degree of pollution control than was required at the time of the Agreement. The provision for "secondary treatment" by July 1, 1977, and "best available technology" by 1983 together with more restrictive requirements for planning, permit and grant eligibility has caused some temporary delays in the programs as pollution control agencies at all levels of government are reoriented.

State agencies are concerned about the complexity of regulations and legal requirements of the new law. The following statement by New York expresses the general attitude of all states:

> "*In the years prior to the passage by the United States Congress of the Federal Water Pollution Control Act Amendments of 1972, Public Law 92-500, the individual States had full control over the selection of wastewater treatment facilities projects on which to proceed to construction. This option was possible due to the provisions of the prior Act, Public Law 84-660 as amended, whereby the*

States had authority to prefinance the inadequate federal funding available for the program.

This authority ended on June 30, 1971, and the temporary continuing legislation deleted the previous reimbursement clauses.

With the passage of Public Law 92-500 on October 18, 1972, full federal funding was required for only those projects eligible under a rigid priority system in accordance with federal guidelines. Other requirements added by the Act or U.S. Environmental Protection Agency regulations, such as complete plans and specifications, infiltration/inflow surveys and analysis, environmental assessment statements and public hearings, cost-effectiveness criteria requiring comparative alternative design; all subject to zealous federal scrutiny, effectively retarded the progress of the program. New regulations affecting construction grants for sewage treatment works projects were promulgated by U.S.E.P.A. on February 11, 1974. The impact of these revised regulations has not been thoroughly assessed, but it appears that further planning requirements may have been superimposed over those previously specified.....

.....The increasing restrictions of the law and procedural regulations of EPA are inhibiting the States from making any reasonable forecast of when pollution abatement facilities can be available, not only in the Great Lakes drainage area, but within the total State's boundaries."

The current status and accomplishments of all major municipalities discharging directly to the boundary waters as well as the significant upstream dischargers are listed in the Appendix to this report which is available from the IJC Regional Office, Windsor, Ontario.

Those municipalities that are not expected to meet a December 31, 1975 completion date, are described in the following paragraphs.

Michigan

The Detroit Metropolitan Wastewater Treatment plant serving in excess of 3 million people in Detroit and suburbs was required by a joint state-federal enforcement action to complete its first two secondary treatment systems by November 11, 1973. The aeration units were completed, but sludge handling facilities, incinerators and final settling tanks will not be completed until July 1974. Attempts to develop an interim landfil disposal area for sludge were not successful.

Increased flow of raw sewage and inadequate incineration capacity (further reduced by air pollution controls) have resulted in an increase in phosphorus loading to the Detroit River over 1972. Interim facilities are currently removing 55 percent of influent phosphorus.

Funding has not been a cause for delay in construction to date, but, because grants are awarded to construct successive phases of the project on a year-to-year basis, the scheduled completion date for full secondary treatment by 1976 may be delayed as much as two years by impoundment of federal funds.

The Wayne County Plant at Trenton (12,000) and the plant at Grosse Ile (10,000), both primaries discharging to the Detroit River, are awaiting funds for required secondary facilities scheduled for completion in 1977.

Algonac (3,500), East China Township (1,700) and St. Clair (5,000), all primary plants discharging to the St. Clair River, are scheduled for completion of secondary facilities in 1976, 1977 and 1976 respectively. All three

plants are in the early planning stages and could proceed when funds are available.

Lansing (130,000), Michigan is served by a secondary plant discharging to the Grand River about 150 miles upstream from Lake Michigan. Bids have been taken for tertiary treatment facilities scheduled for completion in 1976.

Sault Ste. Marie (14,000) has a primary plant which was scheduled for the addition of phosphorus removal by June 1972. Under present EPA grant and permit regulations both phosphorus removal and secondary treatment are required. The city is now awaiting a grant for construction of these facilities scheduled to be completed by June 1977.

Minnesota

Duluth - Western Lake Superior Sanitary District facilities, which include nine municipalities and all major industries on the Lower St. Louis River, will be funded in FY 1975 and is scheduled for completion in 1976. Where a construction need exists in other municipalities within the basin, facilities will be completed when federal funds become available and are distributed by the State in keeping with its priority needs list.

Ohio

The City of Cleveland and thirty-three suburban districts formed the Cleveland Regional Sewer District. In July, 1972, the first meeting of the Board of Trustees was held.

The proposed program consists of expansion of three treatment plants and construction of five major interceptors:

1. The Westerly plant will be expanded to 50 mgd physical-chemical treatment by 1976. Interceptors are 5 percent complete. Phosphorus removal facilities are in operation and some equipment has been placed on order for the treatment facilities.

2. The Easterly plant will be expanded to 170 mgd advanced treatment by 1976. The plant has phosphorus removal facilities in operation and construction of the expansion is 30 percent complete.

3. The Southerly plant will be expanded to 200 mgd advanced treatment by 1978. Phosphorus removal facilities are in operation and plans for plant expansion have been approved.

The Euclid secondary treatment plant was scheduled for completion of additional treatment by December 1973, but will not be completed by 1975. Phosphorus removal facilities are in operation. Enforcement action has been initiated against the City of Euclid.

New York

Buffalo and Niagara Falls facilities, although presently under construction, will not be completed until 1979 and 1976 respectively. The cities of Tonawanda and North Tonawanda are expecting approval of federal funding in fiscal year 1974 with plant completion in 1976-77. Syracuse is expected to have adequate treatment facilities in operation by 1979.

Ontario

In the Upper Lakes Basin, four municipal projects have been delayed. Completion of the treatment projects at Thunder Bay (sewered population 80,000) and Red Rock (population 1,850) on Lake Superior are now expected in 1976. In the Lake Huron Basin, extensive engineering studies have delayed completion of the Town of Blind River (population 2,500) project to 1977. The Ministry of the Environment has undertaken enforcement action against the Town of Thessalon (1,800 persons) for contravention of a 1970 Ministerial Order which required development of a sewage treatment project.

Great Lakes System

In summary, considerable progress has been made in providing needed municipal waste treatment facilities for the 20.1 million (1971) persons served by sewers in the Great Lakes System (See Figure 4.). However, by the end of 1975 the sewage from 6.5 million persons will still not be receiving adequate treatment.

Financial Resources

CANADA - ONTARIO

Assistance from the Federal Government for pollution control works has been made available to all of Canada since 1960 through the Central Mortgage and Housing Corporation (C.M.H.C.) under a revision to the National Housing Act. Thereby, long-term financing is provided for sewage treatment and trunk sewers at preferred interest rates for 2/3 of the eligible project value, with forgiveness of 25 percent of the value of the loan. The Canada/Ontario

Agreement provides for up to $167 million of C.M.H.C. funds and $95 million of Ontario Treasury funds to be allocated on a cash flow basis for the construction of municipal pollution control facilities in the lower lakes basin at both direct and tributary sources over a 5-year period up to December 31, 1975. A similar funding arrangement is being negotiated to assist financing of municipal projects in the Upper Great Lakes Region.

Through the Ministry, Ontario acts as an agent for 30-year, low interest rate financing, construction and operation of sewage treatment facilities.

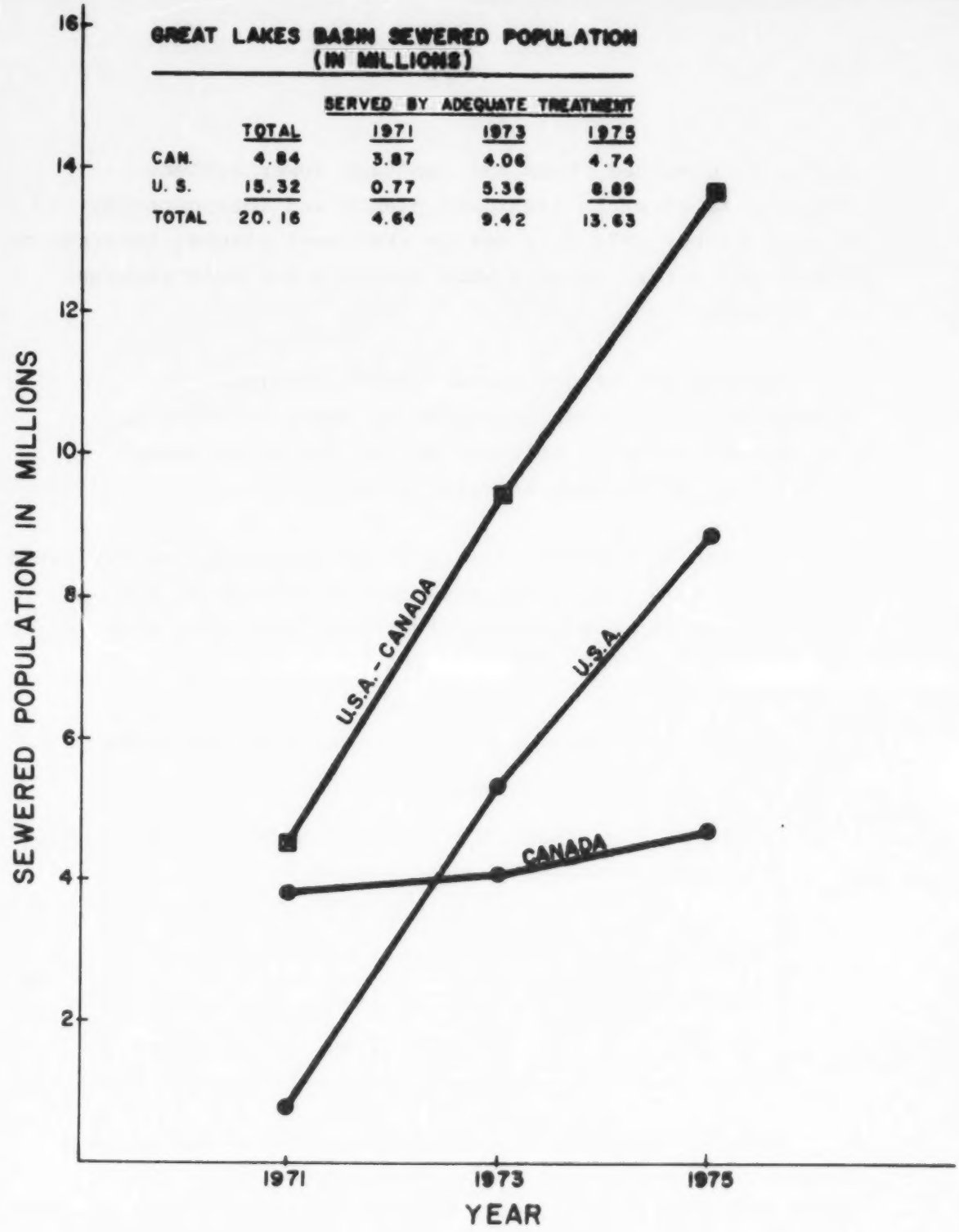
Area facilities designed to serve more than one municipality are subsidized to the extent of 15 percent of the capital cost. The Province of Ontario also provides financial assistance for up to 75 percent of the capital cost of sewage facilities where these costs exceed $130 per lot. The remaining capital costs are amortized over a period of 40 years. In this scheme of financing, the total capital cost of the system is carried by the Province and the municipality rents the system on a "use" basis.

UNITED STATES

Under the provisions of Title II of the Federal Water Pollution Control Act as amended October 1972, the Environmental Protection Agency is authorized to make grants to municipalities to assist in the construction of publicly owned treatment plants. The federal share is 75 percent of the eligible cost of the project. Eligible costs now include: sewage collection systems, methods for abating, preventing or reducing storm water and industrial wastes, and

GREAT LAKES BASIN SEWERED POPULATION (IN MILLIONS)

	TOTAL	SERVED BY ADEQUATE TREATMENT 1971	1973	1975
CAN.	4.84	3.87	4.06	4.74
U. S.	15.32	0.77	5.36	8.89
TOTAL	20.16	4.64	9.42	13.63



SEWERED POPULATION SERVED BY ADEQUATE TREATMENT IN THE GREAT LAKES SYSTEM

FIG. 4

wastes in combined storm and sanitary sewer systems. Priority is given to treatment plants and interceptors. Before October 1972 only sewage treatment plants, interceptor sewers and outfall sewers were eligible for construction grant funds.

Section 207 of the amended act authorized appropriation of funds each year as shown in Table 6. The amounts actually released by the Executive Branch of the U.S. Government are also shown.

Litigation has been initiated by Minnesota, Pennsylvania, Wisconsin, Ohio and Illinois to obtain release of the nine billion dollars of the authorized funds that were impounded by the Executive Branch.

TABLE 6

TOTAL U.S. FEDERAL FUNDING UNDER PL 92-500

	Authorized	Released
FY 1973	$5 Billion	$2 Billion
FY 1974	$6 Billion	$3 Billion
FY 1975	$7 Billion	$4 Billion

The funds are allocated to each state according to a formula that emphasizes state established needs. Each state then distributes funds on a priority system within the state.

In the Great Lakes states, the EPA Administrator adopted a policy to require priority expenditure within the Great Lakes Basin of each state. However, in the 1974 amendments, this procedure was prohibited. States may assign priorities to Great Lakes projects if they wish, but cannot be required to do so. This provision in the law is not expected to change the schedule for construction in the Great Lakes Basin.

Table 7 shows the amounts of money available to each State for the construction of municipal waste treatment and control facilities in the Great Lakes Basin.

TABLE 7

U.S. FEDERAL FUNDING IN THE GREAT LAKES BASIN
(in millions of dollars)

State	Grants Awarded 4/15/72 - 12/31/73	Expected Obligations 72 - 73 - 74
Indiana	15.5	37.9*
Michigan	236.5	230.3
Minnesota	4.3	10.9
New York	69.9	210.3
Ohio	71.5	**
Pennsylvania	.8	3.1
Wisconsin	20.1	63.4
Total	418.6	

* Not a final priority list
** Not available

INDUSTRIAL PROGRAMS

The control of pollution from industrial activites, particularly those which result in the discharge of mercury, toxic persistent organic chemicals, heated effluents, or radioactivity are of major concern in the Great Lakes Basin.

Establishment of Waste Treatment and Control Requirements

CANADA - ONTARIO

At the Federal level, a comprehensive program is underway to develop regulations limiting the discharge of effluents from industrial operations. The regulations are developed under the Fisheries Act and incorporate the principles of best practicable technology for both the treatment of waste waters and the minimization of water use.

To date, three sets of regulations covering the pulp and paper industry, mercury discharges from the chlor-alkali industry and the petroleum refining industry have been promulgated.

The development of these regulations is a co-operative exercise between the Federal and Provincial levels of government as well as the appropriate industrial sector. In the Province of Ontario the Ministry of the Environment has agreed to adopt the regulations and an arrangement has been worked out whereby the Ministry of Environment is generally responsible for the exisitng regulations. Anticipated schedules for promulgation of new regulations will be reported in the next annual report.

The Ontario program for the abatement and control of industrial waste discharges is essentially unchanged.

Although guidelines with respect to effluent quality have been established for certain existing industries, namely the pulp and paper and petroleum refining industry, an individual approach, predicated upon compliance with the water quality objectives, is used.

Companies have been encouraged by the Ontario Ministry of the Environment to research alternatives to attain objectives; consequently, abatement programs are tailored to individual needs and problems. Commitments to detailed programs have been formalized in Ministerial Orders issued to several companies. For example, the chlor-alkali and pulp and paper mills in the Province were required by Ministerial Order in April 1970 to reduce mercury losses to minimum practicable levels, and by 1971 all sources were in compliance.

Considerable research, particularly in the field of pulp and paper, is being conducted across Canada and elsewhere, and the Ministry is monitoring this work. New developments will certainly be promoted when their feasibility has been demonstrated. Technology for the control of toxicity in paper mill effluents is still lacking. However, the use of aerated lagoons seems to be the best approach to date.

A summary of the major problems, accomplishments and projections follows:

Lake Superior. The pulp and paper mills continue to discharge large quantitites of pollutants to the lake. Although the control of suspended solids has been achieved,

the reduction of other forms of pollution is proceeding slowly.

With respect to the kraft mills, it has been determined that taste and odour problems can be alleviated by the stripping of condensates. Facilities for this purpose have been installed at the Great Lakes Paper Company and are near completion at Domtar Packaging, Red Rock.

The projected expansions of waste control facilities at the kraft mill of Great Lakes Paper Company Limited (at Thunder Bay) will include measures such as black liquor oxidation, condensate stripping and biological treatment. Expansion is expected to be completed by 1975.

The sulphite mills have changed processes to higher yield pulping, which has resulted in lower unit loadings of BOD. Encouraging results have been achieved in the biological treatment of sulphite wastes.

St. Marys River. The Algoma Steel Corporation and the Abitibi paper mill at Sault Ste. Marie are now committed to abatement programs as a result of Ministerial Orders issued to these companies. It is expected that the Algoma Steel Corporation will conclude its staged program in 1976 and Abitibi will conclude the primary phase of its program in 1974.

Lake Huron. The Eddy Forest Products mill discharging to the Spanish River has installed primary treatment facilities and is investigating condensate stripping and biological treatment.

St. Clair River. The petroleum and chemical plants are the major contributors to impairment of the water quality of the river. Specific problems relating to fish tainting and toxicity have been identified.

Polysar Limited is adopting a staged program consistent with the water quality objectives for implementation between 1974 and 1976.

Shell Canada Limited is continually improving the operation of its waste treatment and control system which was completed in 1973.

Mercury cells have been replaced at Dow Chemical of Canada Limited and process changes have been undertaken to reduce dissolved solids, particularly chlorides. This project is expected to meet the 1975 target date.

Imperial Oil Enterprises is carrying out a staged program of abatement. Dual media filtration of refinery effluent is expected to remove particulates and traces of oil. A similar approach has been very successful on the petrochemical plant effluent. After the filter becomes operational in 1974, the company will investigate the further reduction of dissolved hydrocarbons.

Detroit River. Two soda ash plants are the major problems on the Detroit River. Allied Chemical Canada Limited and BASF Wyandotte Corporation both discharge large quantities of inorganic dissolved solids. Although significant reductions have been attained over the years, disposal of large quantities of salts is an inherent

problem with the Solvay Process.

Lake Erie. There are no significant areas of non-compliance on Lake Erie. Major industrial developments, including a steel mill and an oil refinery, are taking place at Nanticoke, and this development is being carefully monitored by the Ontario Ministry of the Environment to ensure that the impact is minimized.

Lake Ontario. Both of the steel mills (Stelco and Dofasco) at Hamilton have presented comprehensive pollution abatement programs, which, if completed on schedule, should result in objectives being met by 1975.

St. Lawrence River. Completion of the segregation and diversion of wastes from Courtaulds (Canada) Limited is to be accomplished by 1976.

UNITED STATES

The National Pollutant Discharge Elimination System (NPDES) Permit Program, after a slow start in terms of permits issued, is developing into an effective permit program for industrial point source discharges. Early progress was slowed because of the time required for the development of effluent guidelines and permit processing procedures. By the end of 1973 the program was well under way and by the end of 1974 permits are expected to be issued to all major dischargers.

Permanent authority to operate the permit program was granted to the State of Michigan in October of 1973. Wisconsin and Ohio are expected to obtain this authority within the first few months of 1974;

Minnesota, Illinois, Indiana, New York and Pennsylvania should receive authority by late summer of 1974.

Table 8 shows the program's scope in terms of numbers of applications and the status of the issuance of permits as of December, 1973.

By Federal law, industrial permits must be issued to all point source dischargers by December 31, 1974. Issuance of a permit means that the industry is in compliance or proceeding on a schedule which will result in attainment of an effluent quality corresponding to that expected from the Best Practicable Technology (BPT) currently available (as defined by the U.S. EPA). Where the effluent quality guidelines by the EPA are not sufficient to meet water quality objectives, the permit system must impose more stringent effluent limitations. Dates for achieving operational levels of effluent quality as defined by the permit program vary for each particular discharge, but compliance can be no later than July 1, 1977. This represents the deadline by which all industrial discharges are to be practicing BPT. Effluent Guidelines defining BPT have been published by the U.S. EPA for all of the industries shown in Table 9.

Because both the U.S. EPA and the eight states are in the midst of implementing the NPDES permit program, it is not possible to arrive at an adequate estimate of expected delays in individual industrial programs at this time.

Specific reasons for this are the following:

1) NPDES Permits have varying compliance schedules, and the only applicable deadline

TABLE 8

INDUSTRIAL NPDES PERMIT APPLICATIONS

IN THE GREAT LAKES BASINS

Lake Michigan				**Lake Superior**			
Illinois	-	9	(0)	Michigan	-	15	(6)
Indiana	-	42	(1)	Minnesota	-	31	(1)
Michigan	-	297	(27)	Wisconsin	-	18	(4)
Wisconsin	-	170	(14)	Total	-	64	(11)
Total	-	518	(42)				
Lake Erie				**Lake Ontario**			
Indiana	-	43	(3)	New York*	-	135	(7)
Michigan	-	172	(17)				
New York	-	26	(1)	Total	-	135	(7)
Ohio	-	384	(12)				
Pennsylvania	-	19	(2)	**Lake Huron**			
Total	-	644	(35)	Michigan	-	95	(13)
				Total	-	95	(13)

Total in Great Lakes System 1,456 (108)

( ) - Number of Permits Issued as of December, 1973.
* - Includes International Section of St. Lawrence River.

TABLE 9

PROPOSED INDUSTRIAL EFFLUENT GUIDELINES*

CATEGORY	DATE PROPOSED IN FEDERAL REGISTER
Beet Sugar Processing	8/22/73
Insulation Fiberglass	8/22/73
Electroplating	10/5/73
Feedlots	9/7/73
Plastics and Synthetics	10/11/73
Cement	9/7/73
Organic Chemicals	12/17/73
Meat Products	10/29/73
Canned Fruits and Vegetables	11/9/73
Sugar Processing	12/7/73
Inorganic Chemicals	10/11/73
Soaps and Detergents	12/26/73
Fertilizer	12/7/73
Phosphates	9/7/73
Petroleum Refining	12/14/73
Nonferrous Metals	11/30/73
Ferroalloys	10/18/73
Leather	12/7/73
Rubber	10/11/73
Dairy Products	12/20/73
Grain Milling	12/4/73
Glass	10/17/73
Asbestos	10/30/73

* Listing as of December 31, 1973.

under law is July 1 of 1977.

2) Many NPDES Permits to be issued during 1974 are expected to result in litigation causing indefinite delays.

3) Effluent guidelines for several industrial classifications may not be promulgated until the end of 1974. This is resulting in delays to the issuance of certain permits. Also, this means that only an interim baseline (interim guidance) is available from which to judge the adequacy of individual waste discharges.

Finally it should be emphasized that although the majority of permits are expected to be issued in 1974, they will have final compliance dates well beyond December 1975.

Mercury and Other Toxic Heavy Metals

Effluent Guidelines for the inorganic chemicals industry which would specify limitations for chlor-alkali plants using mercury cells did not exist as of December 1973. The U.S. EPA, as required by law, published the toxic pollutants list which includes mercury and cadmium. Effluent limitations for these toxic pollutants were published by December 1973, and should be finally promulgated in 1974.

The greatest measure of mercury discharge reduction was achieved during the years 1969-1972. The current status of mercury reduction efforts appears to have changed little

from the time of the last report.

Toxic Persistent Organic Chemicals

The toxic pollutants list, published in 1973 by the U.S. EPA, includes PCB's, DDT, phthalates, and other persistent organics. Effluent limitations for these chemicals were published by the EPA in December of 1973. Continued monitoring of such organics by U.S., Canadian, provincial and state agencies indicates no change in status except for the State of Michigan. A survey of Michigan tributaries in the spring of 1973 showed that 36 per cent of the samples exceeded a PCB concentration of 0.01 ppb compared to 60 per cent of the samples collected in the 1971-72 program.

Canada accepted and implemented the recommendations of the Organization for Economic Co-operation and Development with regard to PCB's.

Thermal Discharges

UNITED STATES

Effluent Guidelines for the electric power industry are scheduled to be published in 1974. No NPDES permits have been issued to Power Plants on the Great Lakes during 1973 and little significant change in status has been noted since 1972.

The following areas should receive special attention by both U.S. EPA and state agencies over the next few years because of potential thermal problems: Saginaw Bay, Michigan on Lake Huron; Monroe, Michigan and Cleveland, Ohio on Lake Erie; and Oswego, New York on Lake Ontario.

CANADA

The power industry is required by the Ministry of the Environment to demonstrate that heated effluents discharged into lakes and rivers do not damage the aquatic environment. Through hearings the government presently seeks public reaction to proposals on a given undertaking at an early stage in the planning process. The Ministry also critically assesses proposals for pre-operational environmental studies by the industry, independently monitors the studies performed, and reviews the planned programs to ensure that thermal effects are adequately monitored. Periodically, temperature and other water quality parameters are measured and samples of biota are taken near the point of discharge of heated effluents.

In view of the unique aspects of Lake Erie, the Ministry of the Environment will require cooling devices to be installed on any future thermal electric generating station on that lake.

Radioactivity

No new significant developments in remedial programs for the control of radioactivity have arisen in either Canada or the U.S. since the first annual report.

OVERFLOWS FROM COMBINED SEWERS

Pollution via overflows from combined storm and sanitary sewers continues to be a major problem in the Great Lakes. All jurisdictions have recognized the problem and most have banned combined sewers for new construction. However, no new programs have been implemented in the past year to reduce this source of pollution.

Because of very high cost of controlling combined sewer discharges by existing methods such as sewer separation little emphasis has been placed on this problem in the past. However, active research programs are underway which will more adequately define the scope of the problem, and lead to the development of the most economical methods of control and/or elimination.

During fiscal years 1966-72, EPA spent about $138 million on municipal pollution control technology. Of this amount, $43.1 million were spent on research and development on combined sewers and storm runoff discharges. The main thrust of this effort has been the refinement and repeated demonstration of a number of existing or conventional approaches to solving the problem. Facilities actually under construction for the control of combined sewer overflow are primary or dual purpose holding facilities. Long-range state and provincial programs were described in the 1972 Great Lakes Water Quality Board Annual Report.

Under the co-ordination of the Canada-Ontario Agreement on Great Lakes Water Quality a program concerned with pollution from storm and combined sewers has been developed. Activities to date have been to initiate definition of the magnitude of the problem in the Great Lakes Basin; to establish priorities and schedules for studies directed towards defining potential solutions to pollution problems associated with storm and combined sewers, and to develop a strategy for implementing solutions to the problem. Principal Research and Development activities have been related to the assessment of models for defining urban run off and a preliminary examination of the applicability of a number of treatment devices. Funding during 1973 was about $100,000 and is estimated at $500,000 for 1974.

EUTROPHICATION

The major effort to control eutrophication in the Great Lakes is directed to reducing the input of phosphorus. Programs are being implemented in both Canada and the United States to reduce the phosphorus content of detergents and/or remove it from domestic sewage.

Data are presented which indicate that the programs are succeeding in reducing the gross phosphorus loadings in accordance with the schedule developed in the Canada - United States Agreement, Annex 2, and Appendix I.

State and Provincial Programs

The phosphorus control programs which the states and the Province of Ontario have adopted are summarized in Table 10.

Ontario, Indiana, Michigan and New York have laws limiting the phosphorus content of laundry detergents. Illinois, Minnesota, Pennsylvania and Wisconsin have no state-wide law restricting the level of phosphorus in detergents, but some local areas have passed legislation restricting the phosphorus content of laundry detergents.

All jurisdictions have programs requiring the reduction of phosphorus in municipal and industrial wastes. These programs were scheduled to be completed in each lake basin no later than the date shown in Table 11.

TABLE 11

TARGET DATES FOR PHOSPHORUS CONTROL

Lake Basin	U.S.	Canada
Lake Superior	1975	*
Lake Michigan	1972	NA
Lake Huron	1977	*
Lake Erie	1971	1973
Lake Ontario	1975	1975

* Local requirements in effect only, basin-wide controls under study.

TABLE 10

PHOSPHORUS CONTROL PROGRAMS

JURISDICTION	DETERGENT LAWS	MUNICIPAL CONTROL	INDUSTRIAL CONTROL
Canada Ontario	20% P_2O_5 August 1, 1970 5% P_2O_5 January 1, 1973	1 mg/l P	Certification
Illinois		3 mg/l PO_4 Dec. 1972	Permits
Indiana	0.0% P Industry 1972 0.5% P laundry detergent	80% removal P	Permits 80% removal
Michigan	8.77% P December 1972	80% removal P	Permits
Minnesota		1 mg/l P	Permits
New York	8.77% P December 1971 0.0% P June 1973	1 mg/l P	Permits
Ohio	0.0% City of Akron	80% removal P	Permits
Pennsylvania		1 mg/l P	Permits
Wisconsin		85% removal P for population 2,500 or more	Permits

The progress in implementing the phosphorus control at municipal treatment plants is shown in Table 12. At the end of 1973, phosphorus removal facilities were reported to be "on line" at 275 of the 604 treatment plants requiring such facilities at this time in the Great Lakes system. In the critical Lake Erie Basin, approximately half of the plants have facilities ready for operation. These plants will provide phosphorus removal for over 80 percent of the sewered population in the basin.

The implementation of these programs has resulted in a continued reduction in the input of phosphorus to the Great Lakes.

Phosphorus Loadings

The gross phosphorus loadings to each of the Great Lakes are summarized in Table 13. The "Residual Loads" were calculated from data submitted by the jurisdictions and are displayed with the "Baseloads" and the loads projected under the Canada-United States Agreement, Annex 2 for the Lower Lakes and Appendix I for the Upper Lakes. Also shown are the reported reductions in loadings (Baseload - Residual Load) for the years 1971, 1972 and 1973. Projected loadings and reductions for 1974 as presented in the Agreement are also included for reference. Details of the comparison between the reported and projected loads for each lake are included in Tables C1 to C5 of the Appendix. The municipal, industrial and tributaries contributions to the total phosphorus loadings on both the Canadian and United States sides are presented in Table 14 for the Upper Great Lakes, and in Table 15 for the Lower Great Lakes and the St. Lawrence River.

TABLE 12

IMPLEMENTATION OF PHOSPHORUS REMOVAL AT MUNICIPAL TREATMENT PLANTS
(December 31, 1973)

STATE OR PROVINCE	LAKE SUPERIOR			LAKE HURON			LAKE MICHIGAN			LAKE ERIE			LAKE ONTARIO			TOTAL BASIN	
	No. of Phosphorus Removal Facilities		Percent of Population Served	No. of Phosphorus Removal Facilities		Percent of Population Served	No. of Phosphorus Removal Facilities		Percent of Population Served	No. of Phosphorus Removal Facilities		Percent of Population Served	No. of Phosphorus Removal Facilities		Percent of Population Served	No. of Phosphorus Removal Facilities	
	Req'd	On Line		Req'd	On Line		Req'd	On Line		Req'd	On Line		Req'd	On Line		Req'd	On Line
Illinois	-	-	-	-	-	-	7	7	100	-	-	-	-	-	-	7	7
Indiana	-	-	-	-	-	-	11	8	51	7	4	94	-	-	-	18	12
Michigan	14	2	2	63	15	10	92	36	34	51	24	79*	-	-	-	220	77
Minnesota	30	2	8	-	-	-	-	-	-	-	-	-	-	-	-	30	2
New York	-	-	-	-	-	-	-	-	-	6	1	26	42	3	4	48	4
Ohio	-	-	-	-	-	-	-	-	-	61	22	81	-	-	-	61	22
Ontario	**	**	-	27	23	41	-	-	-	63	62	98	69	15	3	159	100
Pennsylvania	-	-	-	-	-	-	-	-	-	10	3	80	-	-	-	10	3
Wisconsin	3	1	20	-	-	-	48	48	100	-	-	-	-	-	-	51	48
Total U.S.	47	5		63	15		158	99		135	54		42	3		447	175
Total Canada	-	-		27	23		-	-		63	62		69	15		159	100
Total Basin	47	5		90	45		158	99		198	116		111	18		604	275

* Includes Detroit (Phosphorus removal 55% in 1973 instead of 80% as required)

** Requirement for Phosphorus removal pending completion of Upper Lakes Reference Study

TABLE 13

SUMMARY OF PHOSPHORUS LOADINGS TO THE GREAT LAKES

(Short Tons/Year)

	1971	1972	1973	1974
LAKE SUPERIOR				
Baseload		2,400	2,400	2,500
Reduction		-	300	(200)
Residual Load		2,400	2,100	-
Agreement*		2,400	2,300	2,300
LAKE MICHIGAN				
Baseload		7,800	7,900	8,100
Reduction		1,800	2,700	(2,200)
Residual Load		6,000	5,200	-
Agreement*		6,000	5,800	5,900
LAKE HURON				
Baseload		4,100	4,200	4,200
Reduction		-	200	(400)
Residual Load		4,100	4,000	-
Agreement*		4,100	3,900	3,800
LAKE ERIE				
Baseload	31,400	32,000	33,200	33,500
Reduction	200	12,800	11,500	(16,500)
Residual Load	31,200	19,200	21,700	-
Agreement**	31,200	26,700	22,300	17,000
LAKE ONTARIO				
Baseload	18,400	18,700	19,000	19,200
Reduction	400	2,800	3,800	(3,900)
Residual Load	18,000	15,900	15,200	-
Agreement**	18,000	17,800	16,700	15,300

* Appendix I - Canada - United States Agreement
** Canada - United States Agreement
() Predicted Reduction

TABLE 14

REPORTED PHOSPHORUS LOADINGS TO UPPER GREAT LAKES
(Short Tons/Year)

	Lake Superior		Lake Michigan		Lake Huron	
	1972	1973	1972	1973	1972	1973
UNITED STATES						
Municipal	400	368		499	4	16
Industrial	*	*		14	-	-
Tributaries	1,080	1,012		4,719	1,531	1,437
Total	1,480	1,380	5,975	5,232	1,535	1,453
CANADA						
Municipal	105	55			85	83
Industrial	130	140			1	1
Tributaries	670	570			1,259	1,124
			Input L. Superior		975	1,050
			Input L. Michigan		255	255
TOTAL LOAD	2,385	2,145	5,975	5,232	4,110	3,966

* Total phosphorus discharged to L. Superior by Reserve Mining Company at Silver Bay is not available.

TABLE 15

REPORTED PHOSPHORUS LOADINGS TO LOWER GREAT LAKES

(Short Tons/Year)

	Lake Erie *		Lake Ontario **		St. Lawrence River		
	1972	1973	1972	1973	1972	1973	
UNITED STATES							
Municipal	9,135	12,686	4,050	4,050	40	40	
Industrial	320	233	-	-	-	-	
Tributaries	4,785	3,589	2,275	2,275	220	220	
TOTAL	14,240	16,508	6,325	6,325	260	260	***
CANADA							
Municipal	350	233	2,720	2,570	215	181	
Industrial	145	180	330	240	-	-	
Tributaries	1,570	1,962	1,880	1,492	15	27	
TOTAL	2,065	2,375	4,930	4,302	230	208	
Input from L.Huron	2,890	2,800	-	-	-	-	
Input from L.Erie	-	-	4,670	4,550	-	-	
Input from L. Ontario	-	-	-	-	6,210	6,350	
TOTAL LOAD	19,195	21,683	15,925	15,177	6,700	6,818	

* Includes Lake St. Clair, St. Clair and Detroit rivers

** Includes Niagara River

*** New York Data from Previous Year

Lake Superior

The total phosphorus loading to Lake Superior is estimated to have decreased from 2400 to 2100 tons/year from 1972 to 1973. Ontario reported a 48 percent decrease in the direct municipal discharges and a slight decrease in the tributary loadings, attributed to detergent reformulation. The U.S. side shows no change in the loadings. As in the last report, a potential major phosphorus input from Reserve Mining Company at Silver Bay has not been included.

The direct municipal discharges are largely from two centers. Thunder Bay accounts for 44 of the 55 tons/year from Ontario, and Duluth, Minnesota discharges 239 of the 385 tons/year from the U.S. side. Both cities report slight reductions in their discharges since 1972.

Lake Michigan

About 90 percent of the phosphorus input to Lake Michigan is via the tributaries, and a 700 ton/year reduction has been shown.

Lake Huron - Georgian Bay (including St. Marys River)

The total reported phosphorus loading to Lake Huron has been reduced from 4100 tons/year in 1972 to 4,000 tons/year in 1973. This net reduction of 100 tons/year is attributed to reductions in the tributary loadings of about 100 tons/year each on the Canada and U.S. sides and a 100 tons/year increase in the input from Lake Superior.

Lake Erie (including St. Clair River, Lake St. Clair and Detroit River)

The applied phosphorus loading to Lake Erie is reported to have increased by about 2,500 tons/year from 19,200 to 21,700 tons/year.

On the U.S. side an increase in the municipal load from 9,100 to 12,700 tons per year, an increase of 3,600 tons/year, was reported.

The bulk of the municipal load is from the city of Detroit which reported an increase of 2,800 tons of phosphorus per year over the 1972 reported loading. This has been attributed to sampling and operational difficulties as well as an increase in volume of sewage being treated.

In Ontario, the municipal load is reported to be reduced by 120 tons/year, about a 30 percent decrease. However, tributary loadings increased about 400 tons/year.

Lake Ontario

The gross phosphorus load to Lake Ontario is reported to have decreased slightly due to detergent reformulation in Ontario and New York.

In summary, the implementation of the phosphorus control programs described above has resulted in reductions in the gross phosphorus loadings to the Great Lakes. The total reported phosphorus loadings to each lake, Table 13, is less than that required under the Agreement, Annex 2 and Appendix I, and reductions in loadings equal to or greater than required continue to be achieved.

OTHER ACTIVITIES UNDER THE AGREEMENT

In addition to the major remedial programs described above, the Agreement specifies that specific measures be taken to reduce pollution from (1) Land Use Activities, (2) Shipping Activities, (3) Dredging Activities, and (4) Onshore and Offshore Facilities and that (5) a Joint Contingency Plan be implemented and (6) Hazardous Polluting Substances be identified. The status of all of these activities is described in detail in the 1972 Annual Report. The following briefly describes the major changes or areas of concern regarding these activities during the past year.

Land Use Activities

As reported in the 1972 Annual Report, most jurisdictions have passed some legislation relating to the abatement and control of pollution from agricultural, forestry, and other land use activities. Canadian and U.S. remedial programs previously reported remain essentially unchanged. Notable exceptions are the Ontario prohibition of direct disposal of contaminated snow to water courses except under emergency conditions, and the formation by the Canadian Department of Agriculture of an internal task force to survey existing information on agricultural pollution of the Lower Great Lakes.

Coordination by the International Land Use Activities Reference Group through U.S. and Canadian entities has resulted in progress relating to the assessment of problems, management programs, and research as well as the setting

of priorities relating to the effects of land use activities. The Great Lakes Basin Commission will survey state management and control programs and has contracted research on specific land use categories. A similar program has been initiated for Canada. It is anticipated that the U.S. and Canadian reports will be completed by May, 1974.

Assessment of information by the Reference Group has resulted in the proposal of a number of early action programs considering existing measures and improvement needs. Recommendations are being formulated.

Shipping

Proposed regulations for the control of vessel wastes have been promulgated by the Canada Ministry of Transport and by the United States Coast Guard. However, enforcement of these regulations requires compatability of detailed regulatory provisions and co-ordination of operations with provincial and state programs.

The proposed U.S. vessel waste regulations provide for no discharge of sewage, treated or untreated, into navigable waters. These regulations will become effective for new vessels two years after promulgation of implementing regulations by the United States Coast Guard, and existing vessels must comply with the no discharge requirements five years after promulgation. However, a grandfather clause permits the installation of equipment providing minimum degree of treatment on existing vessels for the life of the equipment.

The Canadian regulations propose either:

1. containment of sewage, or
2. discharge of highly treated effluent which complies with standards contained in the regulations, except that such an effluent may not be discharged within a mile of shore or a half mile of water intakes.

The regulations are to apply to new vessels within two years and existing vessels within five years of their adoption.

The Great Lakes Water Quality Board undertook, through the Implementation Committee, a review of these regulations, and at its Ninth Meeting, on November 9, 1973, resolved that:

> *"Recognizing that no discharge is the only alternative from an enforcement and public health standpoint, we find that the protection and enhancement of the quality of the waters of the Great Lakes requires a complete prohibition of the discharge from all vessels of any sewage whether treated or not into such waters."*

The Board has further recommended that the two-year period for compliance on new vessels be complemented with a three-year period for compliance on existing vessels. Attached to the Board's report was a minority report from two Canadian Board members suggesting that in addition to total containment other options provided in the Draft Canadian Vessel Sewage Regulations, such as flow through devices which meet strict effluent quality, be retained.

Dredging

UNITED STATES

The EPA is currently working toward final publication of its guidelines for the disposal of dredged or fill material in inland navigable waters. The report will also outline criteria to be met in determining acceptability for open water disposal. Characterization of dredged spoil on a case-by-case basis is continuing under existing guidelines in conjunction with designation of diked or upland disposal for spoil determined to be seriously or marginally polluted.

CANADA

The Ontario Ministry of the Environment evaluates each dredging proposal within the province for basis of design, dredging and disposal techniques, scheduling, and sediment quality. Disposal on land or within a diked enclosure is required when sediments are found to be unacceptable for open lake disposal. A total of 98 dredging projects on the Great Lakes, their connecting channels, and tributaries were examined in 1973.

INTERNATIONAL

The International Working Group on the Abatement and Control of Pollution from Dredging Activities is reviewing test dredging procedures, programs, laws, and regulations as prescribed by Annex 6 of the Agreement and was to have submitted its report to the Parties in April 1974.

The Group is nearing completion of Phase I of its two phase report. Phase I is to provide an extensive review of background information. It will include: a general review of beneficial and deleterious effects of dredging on the environment, a history and description of dredging methods and practices; a review and assessment of dredging and disposal site;, the socio/economic considerations at the municipal, state/provincial and federal levels: and a review of legislation, regulations and guidelines.

The Group concluded that the study efforts underway and required could not be finalized in time to submit its report by April 15, 1974. An additional navigational season was deemed essential in order to complete the studies upon which the conclusions and recommendations are to be based. The report is scheduled for completion by April 1975.

The pilot project for the Artifical Island Disposal of Dredgings, located in Mitchell's Bay, Lake St. Clair, was subjected to delays caused by weather and other problems. The project will continue in 1974. The structural frame for the island was prepared for receipt of dredged material.

The preceding project is one of twenty-two research activities being undertaken in Canada. Some twenty-nine research activities have been or are being undertaken by the United States. These research activities have a total estimated cost of 3.9 million dollars. The United States and Canadian projects are estimated to cost 2.5 million and 1.4 million respectively. They include, in

addition to the Artifical Island, a study by the United States on the Applications of Simulated Ecosystem Modelling to Dredged Material Research.

Onshore and Offshore Facilities

CANADA

The Ontario Gasoline Handling Act provides requirements for the storage of liquid hydrocarbons. Guidelines governing the limits of effluent discharges have been developed for chlor-alkali, pulp and paper, and petroleum refining industries.

By 1973 some 820 wells had been drilled into the Ontario portion of Lake Erie. Of these, 386 are active gas producers located mainly east of Long Point. Forty-two of the wells were drilled in 1973. 1973 production was 6200 mmcf. Some 430 wells have been plugged and abandoned or capped. The Ontario Energy Act requires rigid control of drilling and production operations. Such controls have reduced the opportunities for accidents which could cause environmental degradation.

UNITED STATES

Two programs address themselves to the control of pollution from onshore and offshore facilities. They are: (a) the Spill Prevention Containment and Countermeasure Plan (SPCC) under Section 402 of the FWPCA Amendments 1972, and (b) the Oil Pollution Prevention regulations as directed by Section 311 of the same law which became effective January 11, 1974.

Contingency Plan

The Joint Canada-United States Marine Pollution Contingency Plan for spills of oil and other noxious substances in the Great Lakes has replaced the 1971 Interim Joint Contingency Plan. The Plan establishes clear lines of authority and action, preventing delayed response to an emergency due to jurisdictional disputes. The United States Joint Response Center is located at the Rescue Co-Ordination Center, Ninth Coast Guard District Office, Cleveland, Ohio, and the Canadian Joint Response Center is located at the Canada Center for Inland Waters, Burlington, Ontario. The transfer of the operational responsibility from CCIW to the Central Region Marine Services, Ministry of Transport, Toronto, Ontario is anticipated to be effected on April 1, 1974.

An intensive study on how best to deal with spills of oil and other materials is being carried out jointly by the U.S. and Canadian Governments. The study area is the St. Clair River where many problems have occurred in the past. The information generated should be useful in modifying the Contingency Plan to improve the response to spills.

The Province of Ontario reports an increasing number of spill incidents in the conduct of its Contingency Plan. During 1971 a total of 285 incidents were reported; 500 were reported in 1972, and 900 in 1973. While this trend may indicate increased surveillence, these incidents arising from negligence, equipment failure and traffic accidents, underline the importance of increased emphasis on prevention.

Hazardous Polluting Substances

Legislation to control or prevent the manufacture, sale, and distribution of products hazardous to human health and the environment is under development by the government of Canada. The Canadian Environmental Protection Service has awarded a consultant contract (completion March 29, 1974) to develop a list of Hazardous Polluting Substances in the Great Lakes Water Basin to be ranked in descending order of hazard to aquatic life with respect to:

1. toxicity to aquatic life (with identification of harmful quantities)
2. amounts used in Commerce and Industry
3. mode of transport and storage related to amounts packaging and handling techniques.

As directed by Section 311 of the Federal Water Pollution Control Act of 1972 Amendment, the U.S. Environmental Protection Agency is working toward promulgation of regulations for the identification of hazardous substances and harmful quantities thereof. This work is expected to be completed by September 1974.

It is anticipated that, on completion of these studies, joint Canadian - U.S. efforts will be undertaken to develop the required Annex under Article V.1 (i) of the Great Lakes Water Quality Agreement.

MONITORING, SURVEILLANCE AND ENFORCEMENT

CANADA

There is no change in the status of programs as described in the 1972 Annual Report.

UNITED STATES

NPDES Permits, which are being issued to all industrial and municipal dischargers, contain monitoring requirements which specify the frequency of sampling and parameters to be measured. Data must then be submitted on a monthly basis to the permit issuing authority. This data, along with data gathered from agency and industrial surveillance programs, will be entered into EPA data systems. Substantial delays are expected before the data can be retrieved for inventory purposes. This is because complete inventories cannot be obtained until all permits have been issued and until computerized data storage problems have been solved.

Responsiblity for enforcement of NPDES permits rests either with the U.S. EPA or the individual states where they have been granted permit issuing authority. PL 92-500 provides that a discharger may be fined up to $10,000 a day if the conditions of a permit are violated. Willful or negligent violations could bring a fine of up to $25,000 a day and one year in prison for the first offense, and up to $50,000 a day and two years in prison for subsequent violations. U.S. EPA may conduct enforcement proceedings jointly with state agencies or independently through issuance of administrative orders enforceable in Federal court, and may also seek court action directly.

WASTE LOADINGS

Under the terms of the Agreement, programs are being implemented to reduce the inputs of pollutants to the Great Lakes system through municipal and industrial waste discharges to levels consistent with the achievement of the water quality objectives. It will be several years before identifiable trends in improvement of specific water quality parameters in the open waters of the lakes can be identified. Therefore, the changes in waste loadings to the lakes should provide a means for gauging the effectiveness of these remedial programs.

The basic pollution parameters routinely monitored at most point source discharges include BOD_5, SS, TDS, and total P. The annual amounts of these constituents being discharged to each of the Great Lakes and the major connecting channels in 1972 were presented in Tables 1 through 10 of the 1972 Annual Report. The data received for 1973 have been reduced and included with the 1972 data for comparison in Tables B1 through B6 of the Appendix to this report.

It is apparent that the data submitted and the time available for its analysis are not adequate to assess the short-term effects of the remedial programs with any degree of confidence. Different assumptions, data periods, and methods of calculating loads, as well as incomplete data, are reported by the various jurisdictions.

In addition the determination of tributary loadings is not sufficiently precise at this time to permit their use in the short-term evaluation of remedial programs. This is especially true in the Upper Lakes where, for example, tributaries constitute an estimated 70 percent of the phosphorus load to Lake Superior and over 90 percent to Lake Huron and Lake Michigan. Variations in stream flow and measurement of low concentrations of pollutants in these streams will require a long-term data period to establish significant trends. Year to year changes can only be evaluated through a complete and accurate inventory of all point source discharges within a given basin.

The data required for this evaluation are not currently available from submissions from the jurisdictions. It will require several months of intensive effort to develop and analyze this type of information; however, it is essential that it be done if citizens are to be fully informed as to the status of efforts to reduce the pollution of the Great Lakes.

Recognizing the above needs, the Board, at its March 1974 meeting, requested the IJC Regional Office to meet with the jurisdictions and make an in-depth study of the data available from all significant point source discharges within each jurisdiction. Based on this information and in consultation with the jurisdictions, the Regional Office can through the appropriate committees recommend to the Water Quality Board a uniform method of determining annual point source loads, including standard assumptions, which can be adopted. The purpose of the program will be

to provide a usable inventory of waste discharges that will permit meaningful comparisons from year to year. The data collection also must be expected to cover all the parameters mentioned in the Agreement.

OTHER ACTIVITIES UNDER THE AGREEMENT

THE UPPER LAKES REFERENCE GROUP

The Upper Lakes Reference Group (ULRG) has met four times since the Second Semi-Annual Report was submitted. The U.S. and Canadian Sections have also met separately during this period. Four formalized Work Groups which are implementing the approved Study Plan have each met several times and are functioning very well. An Executive Committee consisting of the Work Group Co-Chairmen has been organized to provide a continuing overview of Study Plan progress and problems. The Executive Committee meets separately and with the Reference Group Co-Chairmen just prior to scheduled meetings of the entire Reference Group. Major activities of the ULRG and items of interest to the Water Quality Board (WQB) are presented in a more detailed report and plan of study under a separate cover.

LAND USE ACTIVITIES REFERENCE GROUP

In the past year the Reference Group along with other specialists have devoted considerable time and attention to the development of a detailed study plan. The Reference Group held its fifth, sixth and seventh meetings in September and November 1973 and in February 1974.

Four Task Groups have been identified by the Reference Group to accomplish its work. Several meetings have been

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held. The individual tasks for these groups are listed as follows:

Task A

To assess problems, management programs and research and to attempt to set priorities in relation to the best information now available on the effects of land use activities on water quality in boundary waters of the Great Lakes.

Task B

Inventory of land use practices and relevant physical data, with emphasis on certain trends and projections to 1980 and if possible to 2020.

Task C

Intensive studies of a small number of representative watersheds, selected and conducted to permit some extrapolation of data to the entire Great Lakes Basin and to relate water quality which may be found at river mouths on the Great Lakes to specific land uses and practices.

Task D

Diagnosis of degree of impairment of water quality in the Great Lakes, including assessment of concentration of contaminants of concern in sediments, fish and other resources.

Portions of Tasks A and B have been initiated. A detailed Summary of Activities of the Reference Group is given in the Progress Reports to the Great Lakes Water Quality Board.

RESEARCH ADVISORY BOARD

The Research Advisory Board was established under provisions of the Canada-United States Agreement on Great Lakes Water Quality. The functions of the Board are to review research activities concerned with and applicable to the quality of the waters of the Great Lakes System, to make recommendations to the International Joint Commission (IJC) concerning research needs, and to provide scientific advice on specific problems referred to the Board by both the IJC and Great Lakes Water Quality Board.

The Board has established seven standing committees which are to provide advice on significant developments, propose research projects, and identify gaps in the knowledge of their specific areas of research as they relate to Great Lakes water quality.

Other activities of the Board include initial consideration of a proposed study of the IJC hearing process and a special report on research needs.

APPENDICES

A. PROGRESS OF MUNICIPAL PROGRAMS

This appendix lists the direct and significant upstream municipal discharges to the Great Lakes System. The listing indicates the wastewater treatment works or other control measures required at each municipality as of April 1972 (Canada) or the needs as of December 1971 (U.S.A.). Also included is an estimated cost and completion date for the remedial measures required, their status as of December 1973, and any additional requirements or improvements now needed.

B. SUMMARIES OF WASTE LOADINGS

Available information on the 1972 and 1973 annual loadings of Total Phosphorus, Biochemical Oxygen Demand, Total Dissolved Solids, and Suspended Solids to each of the Great Lakes is summarized.

C. COMPARISON BETWEEN REPORTED AND PROJECTED PHOSPHORUS LOADINGS IN THE GREAT LAKES

This appendix compares the annual phosphorus loadings to each of the Great Lakes for 1971 through 1974 to the projected loadings under the Great Lakes Water Quality Agreement, Annex 2 and Appendix I.

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Copies of the above Appendices may be obtained from:

International Joint Commission
Great Lakes Regional Office
100 Ouellette Avenue
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1973 MEMBERSHIP LIST

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